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[GENERAL ANNOUNCEMENT.]

## THIRTY-FIRST ANNUAL MEETING, AMERICAN GAS LIGHT ASSOCIATION.

AMERICAN GAS LIGHT ASSOCIATION,
OFFICE OF THE SECRETARY,
58 WILLIAM STREET, N. Y. CITY,
September 16, 1903.

There will be an annual meeting of the American Gas Light Association held at Detroit, Mich., October 21st to 23d, 1903.

The meeting will be called to order by the President, Alten S. Miller, of Baltimore, Md., at 10 A.M., Wednesday, October 21st.

The Meeting Hall will be announced later.

The headquarters will be in the Russell House, Detroit, Mich.

The most satisfactory quarters are always obtained by writing in advance to the hotel people, and in doing so a reply should be requested, for which a self-addressed, stamped envelope should be inclosed, as misunderstandings may be averted.

The Russell House is conducted on both the American and European plans, and the rates for rooms will be as follows:

American Plan: Rooms without bath, $3 per day for each person; rooms with bath, $4 per day for one person, or $7 per day for two persons ($3.50 per day for each person) and upward.

European Plan: Rooms without bath $1.50 per day for each person; rooms with bath, $2.50 per day for each person, and upward.

Another hotel is the Cadillac, which is not far from the Russell House, and the rates of which are about 50 cents per day higher than those quoted by the Russell House.

The roll call will be made by means of the door card system. Each member upon entering the hall for the first time will, at the door, receive a special card upon which he will find his name, address, etc., as it appears on the Secretary's books, and such card should be corrected and given to the doorkeeper. Members in attendance should attend to this very carefully, as these cards are used immediately after the meeting for correcting the annual membership list. Visitors will please hand to the doorkeeper their personal cards.

A blank form of application for membership accompanies this circular. More can be obtained of the Secretary.

Remember, all applications must be in the hands of the Secretary by October 11th, at the very latest, otherwise they will not be acted upon at this meeting.

The list of papers to be read at the meeting is as follows:

"Our Correspondence School," by Mr. Alex. C. Humphreys, New York City.

"The Advantages of Enrichment," by Mr. Arthur G. Glasgow, London, England.

"Municipal Ownership," by Mr. H. L. Doherty, New York City.

Other papers are promised, but the authors have not yet decided upon the exact titles, so the announcement of them will be deferred.

If the papers are of a sufficiently high standard, the Beal medal will be awarded to the author of the best paper presented, the question of which is best to be decided by the proper committee.

A lecture will be delivered to the Association.

During the days of the meeting all the announcements will be posted on the bulletin boards at the headquarters and meeting hall. All members are warned to take notice thereof accordingly.

All members attending the meeting are particularly requested to wear their membership badges in plain sight, thereby greatly aiding the officers and the local committee in their work, by affording a ready means of recognition.

In order that the year book containing the report of this meeting may be published and issued to the members immediately after the meeting, notice is hereby given that, if any of the speakers at this meeting desire to correct their remarks before they are printed, they will be given an opportunity before leaving Detroit, but not after. The stenographer will have typewritten copy of the principal discussions prepared at the headquarters between the sessions of the meeting, and all those who desire to correct their remarks must notify the Secretary at the close of the session at which such remarks are made, as all the reports will be turned in to the printer immediately after the adjournment of the meeting.

*Special.*—The entertainment will include a smoker Wednesday evening, a banquet on Thursday evening, and a steamboat excursion on Friday. The boat will stop at various points of interest. For the ladies there will be a theater party on Wednesday evening, and the banquet and excursion as above. The price of tickets for each person will be $5. It will be necessary for members to procure a ticket for each lady accompanying them. Please fill out and mail to the Secretary at once the inclosed postal card, so that the Committee of Arrangements may know how many are to be taken care of.

A. E. FORSTALL, Sec.


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SMITHSONIAN DEPOSIT

## Obituary Minute to the Late Mr. Eugene Vanderpool, President of the Society of Gas Lighting, Passed at Its Last Meeting, September, 1903.

Your Committee, appointed to express the sentiment of this Society upon the death of its honored President, Mr. Eugene Vanderpool, makes this report:

Mr. Vanderpool was born September 2d, 1844, in the city of Newark, N. J., and died there on Sunday, July 12th, 1903. He was graduated at Princeton University in 1864, and subsequently graduated from the Troy (N. Y.) Polytechnic School with the mark of Civil Engineer. He began his career as a gas engineer with the Newark (N. J.) Gas Light Company, in 1866; became its Chief Engineer in 1867, and continued in that position until 1871, when he became President of the Company. He directed its affairs with great skill and judgment, until the sale and consolidation of its properties with other local and like interests in 1895. So implicit was the confidence had in him by his near business associates that they unanimously selected him as the trustee for the bondholders of the old corporation in the new organization that succeeded to the business of the several former gas companies, to protect and care for their interests.

Mr. Vanderpool was one of the original Directors of the Montclair (N. J.) Gas Light Company, and of the East Newark (N. J.) Gas Light Company; also a Director in the Morristown (N. J.) Gas Company and in the American Gas Company, of Philadelphia, Pa.; and was widely interested in the financial side of many other gas undertakings. He became a member of the American Gas Light Association in 1873, and in 1884 was elected to the Presidency of that Association. He was an original member of this Society, became its Vice-President, December 18th, 1884, and upon the death of its honored President, Mr. Joseph R. Thomas, became its President in 1896, continuing in that office until his untimely death. He was Treasurer of the Board of Trustees of the Educational Class of the American Gas Light Association, from the time of the formation of the Class until his death. Mr. Vanderpool was widely known and highly respected in the profession of gas engineering, and his views and opinions were sought for and greatly respected by his fellow engineers in this country and abroad. His contributions to the literature of the profession, while not numerous, always commanded attention as the forceful expression of the opinions of a man thoroughly versed in the letter and practice of his life's chosen work. Always an active, useful citizen of his native city, he never accepted public office, other than that of Presidential Elector, when, in 1896, he felt himself called upon to emphasize his views as a sound money Democrat by accepting such position on the "Palmer and Buckner" ticket of that year; and again, in lending to his fellow citizens his trained knowledge and great ability as an engineer in connection with his membership in the local Park Commission of his native city. Much of the importance and beauty of the present park scheme of Newark bears the impress of his wide research into, and patient study of, the subject of its development.

We, who knew him closely in our social and professional relations, will miss his erect, manly figure and thoughtfully handsome face, and will long feel something lacking in our monthly gatherings; that sense of the presence in the Chair, of a fearless, conscientious man, who had acquired the strength that is born of honest purpose and righteous achievement, and who brought to bear upon us, and all our discussions here, the kindly thought of the courteous gentleman, who, though exceptionally gifted and peculiarly honored and loved by us all, was unselfishly careful of our feelings in his attitude towards us at all times. Memory, that staunch witness, acquits Eugene Vanderpool of all selfish or unmanly efforts to secure his own advancement. Pure of thought, earnest of purpose, honest and true to his convictions, it only remains to say that he was a firm friend and trusted adviser. A man whose kindly heart and interest in our and his affairs made sincere friends, and now earnest mourners of all who really knew him in social or business life.

Therefore your Committee offers the following:

*Resolved*, The Society of Gas Lighting, and as we take it the profession of gas engineering at large, has sustained a great loss in the death of the honored President of the Society, Mr. Eugene Vanderpool, and we desire to place on record, and convey to his family, our sense of their greater bereavement and sorrow, while recording sincere sympathy with them in this our mutual affliction.

WM. HENRY WHITE,
GEO. G. RAMSDELL,
FRED. S. BENSON,
} Committee.

[Continued from Page 406.]

## ELEVENTH ANNUAL MEETING, PACIFIC COAST GAS ASSOCIATION.

HELD IN SAN FRANCISCO, CAL., JULY 21–23, 1903.

FIRST DAY—AFTERNOON SESSION.

The President introduced Mr. John A. Britton, who read his paper on

### HIGH PRESSURE GAS DISTRIBUTION.

[For the text of Mr. Britton's paper, see JOURNAL, Aug. 17, 1903, p. 243.]

*Discussion.*

The President—From the way this paper has been received Mr. Britton must appreciate why the officers desired a communication of this character brought out at this session, particularly by Mr. Britton, who is the pioneer on this Coast in high pressure distribution. I do not like to impose upon Mr. Lowe, but if there is anything he likes more than red lead it is small gas mains and high pressure. We should be glad to hear from Mr. Lowe.

Mr. Lowe—I think you are getting entirely too much "Mr. Lowe." One thing I want to speak of which I noticed while the paper was being read. Mr. Britton spoke of pumping at 150 pounds pressure. In the present state of the art I think that would be hardly advisable. Understand once for all that I am a crank on high pressure gas delivery. I believe that in small towns the largest pipe should be, say, 2 inches and the laterals, say, 1¼ inches, with a governor on every service. The gas governor, of course, must go on before the meter. If you allow high pressure to come on the meter, you may burst it and perhaps destroy lives. It is very necessary to see that the governor cannot go wrong. To come to another point. Gas compressors for economical working are built either for single stage or 2, 3 or 4-stage compression. Two-stage compressors and upwards are expensive. If you are going to go beyond 60 or 70 pounds compression you get beyond the reasonable working limit of single stage compression and you must go into 2-stage compression. As gas governors are made to-day, as you buy them in the market, they are made to handle gas up to about 75 pounds pressure. Now, suppose you were compressing at 75 pounds at the works and something should occur whereby the entire pressure should be thrown on the street main system, every regulator would still be able to handle your pressure. If you had 150 pounds, while it would not injure your street mains, your gas governors might become extremely dangerous. Another point. If you want to get a cheap compression tank to-day it must be a tank about 4 feet 6 inches in diameter and about 29 feet 6 inches long. The reason I state these specific dimensions is that you can put 4 such tanks on a freight car, and anyone who wishes the tanks built cheaply must go out of this market and build them in the East. If you exceed the length limit of 30 feet the freight rate becomes very much greater than if you keep them under 30 feet. Therefore, make your tanks 29 feet 6 inches. Make them 4 feet 6 inches wide, because 2 will go side by side on a car. You can thus get 4 tanks on a car. A $\frac{3}{16}$ tank will have a bursting pressure (if I recollect rightly) of say 300 or 400 pounds per square inch. If you run up to 75 pounds pressure you will still have a safe working limit. If you increase the pressure to 150 pounds you must have a very much more expensive tank. I thoroughly agree with all Mr. Britton has said, except that, in the present state of the art, I believe 75 pounds is the highest reasonable compression.

Mr. Britton—I used 150 pounds pressure in my paper as an illustration only for the purpose of easy figuring.

Mr. Lowe—I understand; but I am always of the opinion that someone not thoroughly conversant with a subject may take a suggestion as being something upon which to act. With the governors found in stock to-day you can safely work up to 75 pounds and have no trouble whatever.

The President—We have with us Mr. Parker who has laid some 17 miles of high pressure pipe. Perhaps he will tell us of his experience.

Mr. Parker—This high pressure line is running between Redwood City and San Mateo. We started in January 12th to lay the pipe. The only part I took in it was to superintend the laying. We used 2½-inch line pipe between the towns, a distance of 8 miles. When we reached the town we sent a 2-inch belt main completely around it, and then joined in with 1-inch pipe. We tested the pipe to 100 pounds pressure and let the gauge stand an hour. Our tests were taken every 1,000 feet on the county road, and on each individual block in the town. We are using an 8-inch by 8-inch by 12-inch compressor, steam driven.

We have no compression tanks and have not found need of any. We pump directly into the mains. There is no holder whatever at San Mateo. Our pressure varies from 10 to 35 pounds. We use the Equitable governor, No. 2, on each individual meter, placed on the service before the meter. Outside of that, we have a safety device filled with oil, and on the vent of each governor we have a little whistle, similar to those on peanut stands, to give the alarm if the diaphragm should burst. We are supplying about 150 people. It has been running only 20 days. The drop in pressure amounts to 20 pounds between the two towns. I have suggested to our Company that we try a Westinghouse compressor such as those used on locomotives of their air break systems. My idea was to try to furnish a steady flow of gas at any pressure we saw fit to give. I have not had anyone offer me any ideas on the subject, for those I talked to had not had any experience. We have very little condensation in our mains. We catch a little about 1,000 feet from the works where there seems to be a sort of vapor or steam. We laid our entire line to grade and put in our drips along the line, laying them in just the same way as we would if it had been a low pressure system. We used 30 expansion joints on the county road, and on the streets in town placed expansion crosses. We put on a stopcock at every one of the plugs so that we could shut out each individual block. We find it very handy in testing out for leaks, though we have been fortunate in not having had very many—only 9 in the whole line since we started.

Mr. Osborn—What was the nature of the leaks.

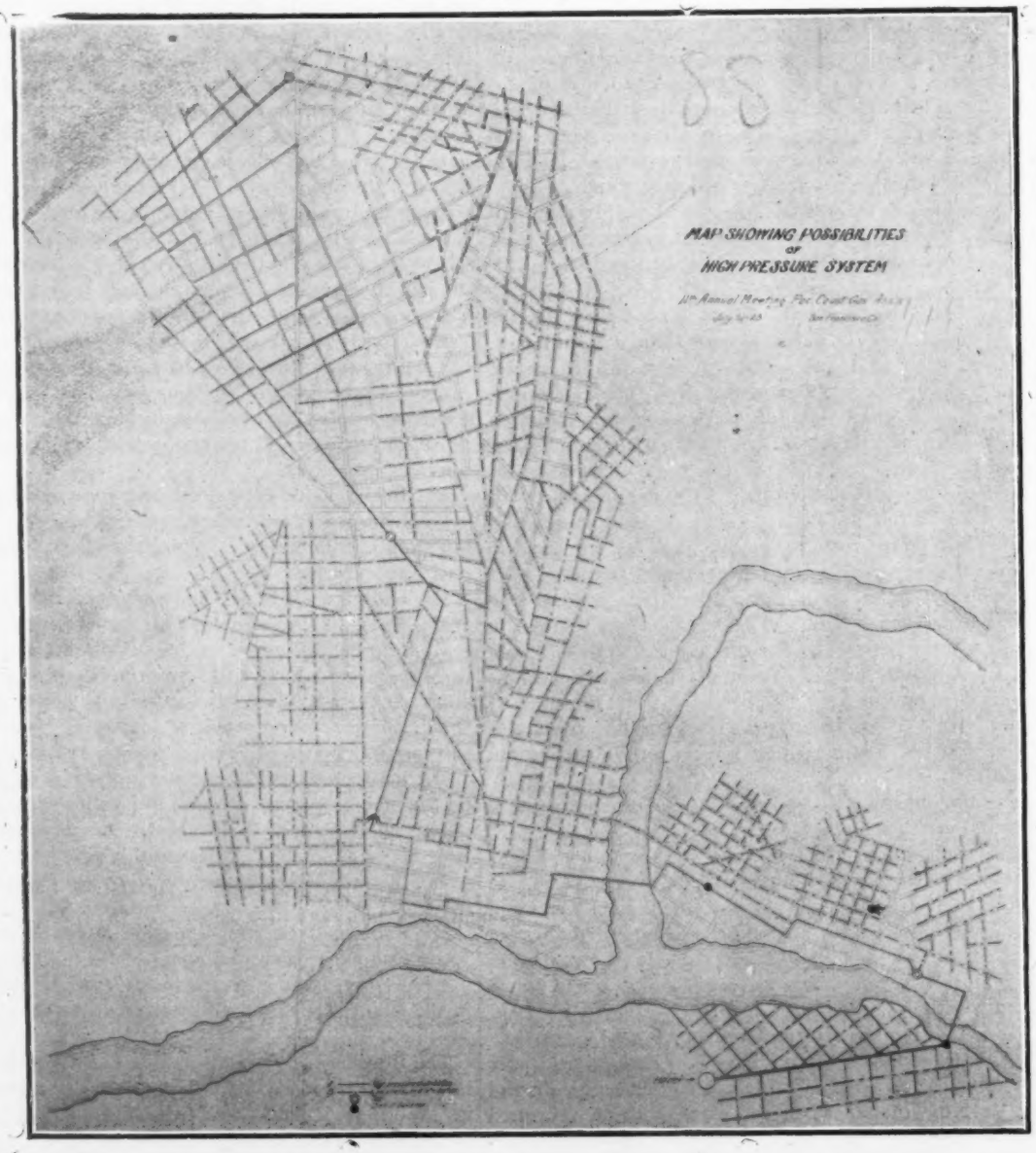
Mr. Parker—They were all found on the 1-inch mains where we joined the ¾-inch services. The trouble seemed to come from the gasket we used. On the 2½-inch line we took from 6 to 8 to 13 lengths and screwed them together by hand with the aid of a wheel and horse. The sockets were all hydraulic sockets. All the pipe was line pipe. We used Dixon's pipe joint compound on all the threads. The same plan was followed on all the pipes.

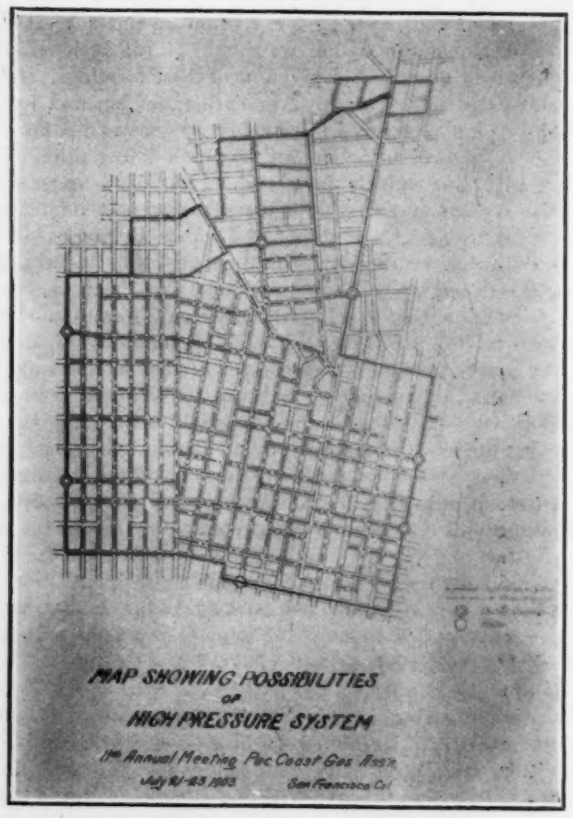
Mr. Aldrich—When I saw on the programme that we were going to be favored with a paper by Mr. Britton on this subject of long distance transmission I knew that we should be the recipients of another one of the many gems he has given us at these meetings. I beg to suggest that, in the history of this Association, as long as I have had the honor of being a member, I have never listened to a paper which has given me so much satisfaction and so much information on a subject in which I was particularly interested. I have had under serious contemplation the installation of long distance transmission at Spokane. I think we all recognize the ability of Brother Britton as an engineer; but I do not think we recognize the time, attention and ceaseless labor which our engineers give to the gas business. It is all very well for us who perhaps know how to sell gas, but I would like to know where we would be if it were not for men like Mr. Britton. Without taking up any more time (for I do not feel competent to criticize at all) I am going to ask Mr. Britton one or two questions which I hope he will answer offhand. I hope the Secretary will soon have the paper in print so that we can assimilate it at our leisure. The first thing I noticed about the paper was that Mr. Britton distinguished between long distance transmission and long distance distribution. Now he did not say anything—but I hope he will say something—about the cost of the plant. Neither did he say anything (and I will ask him to give us some approximate figures) as to the probable cost of compression tanks. When a long distance line is inaugurated I take it that, unless it is merged, as we have it here (referring to map) on a low pressure system, compression tanks are not necessary.

Mr. Britton—That is right.

Mr. Aldrich—Further, in long distance transmission do you advocate central governors or individual governors on each service?

Mr. Britton—That depends very much upon conditions. In answer to your first question as to cost. The cost of a blower of a type which will answer for pressures up to 10 pounds would not exceed (for a capacity of 50,000 feet per hour, operating up to that pressure), completely installed, more than $800. A compression tank, such as Mr.




MAP SHOWING POSSIBILITIES
OF
HIGH PRESSURE SYSTEM
11th Annual Meeting Pac Coast Gas Assn
July 10-11-12-13 1903 San Francisco Cal

Lowe described, built to withstand a pressure of 300 pounds to the square inch, ought not to cost over $350 or $400, delivered here.

Mr. Lowe—They can be had for just $600.

Mr. Britton—As to the matter of governors. Where a low pressure system is to be built up by a high pressure system, and the high pressure system was very extensive, I would advocate the introduction of district governors feeding in from the high pressure route to the low pressure system; and on the high pressure system, in all cases where it is above ½ pound or 1 pound, you should use individual governors. I believe that the Equitable iron, 5-diaphragm meters will withstand, without any governor, a pressure of at least 50 pounds. Possibly they will stand more than that. I have never tested them out to determine it.

Mr. Lowe—The cast iron meter of the natural gas type will stand 100 pounds.

Mr. Britton—I would not care to risk it. There is no telling the life of the meter. Those meters are a little more costly than the tin meter. The No. 2 governors, such as I use, cost, I think, $2.50 apiece. The No 1 and the No. 0 cost proportionately less, being smaller. Mr. Colquhoun has had a great deal of experience in Fresno on the loop proposition such as I have outlined on the map, and can tell you from a practical standpoint just what he has been able to accomplish. There is no doubt but that in Spokane, if you are meeting with difficulties and need to stiffen up your pressure, a pipe 2 inches in diameter, laid to a certain point, with a governor such as we have in Oakland, would answer every purpose for a great many years.

Mr. Aldrich—I would like to know the kind of pipe you use, and whether you use any expansion joints. What means do you take to ascertain the leakage—the unaccounted-for gas on the system? And last, but not least, I would like Brother Britton to explain what is the reason for having no dead ends.

Mr. Britton—Simply that if you promote the circulation in the mains as much as you can you get better results; a more even distribution. There is no other object.

Mr. Lowe—I think the objection to dead ends is very much greater in a low pressure system than in a high.

Mr. Britton—Yes; very much. The leakage is determined in the usual way. In Oakland we have had high pressure for over 18 years. At no time has our leakage ever been over 9 per cent. for the entire system. The leakage at the present time, since this high pressure direct system was connected, has never exceeded 9 per cent., sometimes running as low as 7 per cent., and I do not think we are fooling ourselves on manufacturing results either.

Mr. Clements—Does that include all unaccounted-for gas?

Mr. Britton—Yes. The condition of our drips in Oakland indicates that our system of street mains must be nearly perfect, because during and after the most severe winters, when the earth became saturated there is special liability that water will find its way into defective pipes, we can very rarely find water in any of our drips. All of our pipe is cast iron. We have no wrought iron, high pressure pipe. In Fresno all the high pressure pipe is wrought iron. This high pressure line of ours was formerly a low pressure pipe for supplying Berkeley. We simply turned the high pressure into the old main. I have often told our managers in talking to them about leakage that there was no possibility of leakages such as they present. They are simply fooling themselves as to what they are making the gas for. With a high pressure distribution system, if there were a leak amounting to one-tenth of 1 per cent. the whole neighborhood would be down at your office half an hour afterwards to let you know about it. If there is excessive leakage with minimum results of manufacture, you want to get out and look for defective meters. It does not exist, in my judgment, to any extent in the pipes; and the possibility of ordinary condensation taking place, which accounts for some of the leakage, is not as possible in high pressure. Under a pressure of 10 pounds I doubt if there is any condensation to speak of. I know Mr. Colquhoun with 15 pounds finds very little.

Mr. Colquhoun—We find some about 1½ miles from the works, and we have found it so far as to get into the stoves

Mr. Britton—I fancy that occurred at some time when your pressure was decreased. The initial pressure on our Berkeley line was 2½ pounds. In Berkeley at our office, about the center of the distributing district, the pressure will average, during peak load conditions, about 3 inches.

Mr. Clements—Speaking of condensation, you have practically none. You must take great care of it at your works. There must be some condensation between manufacture and distribution.

Mr. Britton—I think our works are better arranged in one particular than most works are. Our generating station is located at a distance of about 1,100 feet from our distributing station. The gas from the relief holder at the generating station has to pass through 1,100 feet of pipe before it reaches the secondary scrubber; so all the condensation that would ordinarily go from the station where the distance was slight is taken care of in that 1,100 feet. That accounts largely for the absence of the condensation ordinarily occurring in the street mains. The absence of water in the drips is accounted for by the fact that our mains are tight. Mr. Kirk, our Superintendent of Mains, is here. He will bear me out in this statement, and can do it better in detail. In how many of the drips, Mr. Kirk (we have possibly 75 in our entire district) did you find water of any consequence during the winter?

Mr. Kirk—In only one, and that was not more than 500 feet from where the gas leaves the holder. This is the only drip in town that for the last 20 years has bothered us more or less during the winter. There is some defect in the pipe or in the service that I have not been able to locate. There is evidently some place where the surface water gets into the main. It is not condensation. It bothers us only during the heavy rainy season. During the summer we do not find a drop of water. One reason that there is less leakage in our mains is that we use, I think, more lead and heavier pipe than most of the gas companies in the State do.

Mr. Hollidge—What did you say your pressures were?

Mr. Britton—Three inches at the office, which is the lowest point of our supply in Berkeley. Up on the hills it increases with the elevation, reaching 4½ inches.

Mr. Hollidge—What is the pressure on the high pressure main?

Mr. Britton—Two and one-half pounds, diminishing to 3 inches. The reason of the falling off is that along the entire distance of the high pressure pipe we have 3,000 consumers taking gas off every hour of the day. Of these 3,000 consumers fully 50 per cent. have gas stoves.

Mr. Burrows—You speak of a varying pressure on your high pressure main. Do the governors take care of that?

Mr. Britton—Entirely so. A governor at 56 inches of water pressure on the mains delivers the gas at possibly 5 inches on the house pipes. Where there is only 13 inches of water pressure the governor will deliver about 3½ inches. It is sensitive enough to take care of the excess.

Mr. Keyes—What governor do you use, and about what does it cost?

Mr. Britton—It is the Equitable governor, made by the Equitable Meter Company, and costs about $2.50.

Mr. Keyes—I had occasion to use a number and was referred to a firm in the East. They sent me out some governors and charged me $9 apiece for them.

The President—We have with us Mr. Colquhoun, of Fresno, who has had experience in laying high pressure pipe and distributing gas through it. We should like to hear from him.

Mr. Colquhoun—The subject seems to have been pretty well covered. When we first started we were a good deal afraid. Now I wish that our whole system was under high pressure. It simply does away with all the troubles under low pressure. The pressure at the houses is the same at all times. You have no complaints from your stoves. There is no naphthaline. The drips do not bother us to speak of. In fact, it is almost perfect. So far we have had no trouble at all. We laid all our pipe with lead. We have had to use our drips in only about three instances. As far as the danger is concerned with small governors, we vented them all, and I think the size of the vent is equal to the inlet of the governor, so that in case of a break it would relieve itself. Once in a while a governor will creep up a ltttle bit, and we have had as high as 12 inches on the low pressure side.

Mr. Lowe—Does any member know about what pressure an ordinary tin meter will stand?

Mr. Britton—I have tested a tin meter up to 15 pounds without breaking.

Mr. Grimwood—Was it a round or a square meter?

Mr. Britton—Round. I don't think a square meter will stand more than 3 pounds. One point that has not been brought out in this discussion, except incidentally, is that a great advantage of a high pressure system is, when you get up to say 25 or 30 pounds or over, your entire system of pipes acts as a holder. We had trouble at one time last winter in supplying Berkeley without exceeding the pressure I felt to be safe along our cast iron line. Mr. Beck made the suggestion that if he should start in pumping gas at a reasonably low pressure, compared to what he ordinarily carried, he could fill the mains running out in that neighborhood with gas under compression in the same way as if the pipes were compression tanks, so that when the consumers commenced to draw off gas there would be enough to prevent the pressure lowering too rapidly. That course is being pursued and it works admirably. As you get up your pressures you increase your volume of gas by compression in your mains. There is no trouble in supplying with a small 2-inch pipe a district the consumption of which has increased over 200 per cent. since the time of the introduction of the high pressure; something which could not possibly have been done with low pressure.

Mr. Parker—We are about to lay another high pressure line, and we expect to adopt 2-inch pipe for all our mains, simply because it will give us more storage capacity.

The President—Our Secretary, Mr. Grimwood, perhaps laid the first high pressure pipe on the Coast.

The Secretary—There has been so much said about high pressure that it seems useless for me to attempt to say anything more. I think the ground has been covered thoroughly. I believe that I have put higher pressures on street mains than probably any other member of the Association. We have carried in our compression tanks as high as 85 pounds gauge pressure with the ordinary illuminating gas. We have carried over an entire district, serving some 10,000 people, as high as 40 pounds right up to the consumer's governor. That was only for a short time. We consider it advisable to put in district governors, and with a works' pressure of 80 and 85 pounds (ranging from a maximum of 85 pounds down to 25 pounds) we set the district governor to "step down" (we use an electrical term) from 80 pounds pressure to 25 pounds on the low side; and we carry 25 pounds over the entire residence district. From 25 pounds the service governor reduces the pressure down to ordinary gas stove pressure of about 4 inches. In an experience of about a year we have had absolutely no trouble with the governors. We have had, I think, two governors in the entire installation that have been complained of. One of them we found to have a little pin hole in the leather diaphragm. In the other case the governor was set in a low place under a house, and during some of the winter storms the governor, meter and everything else were flooded. There was some little complaint about insufficient pressure. A few days after a cold snap came and the water on the top of the diaphragm froze. Of course, that held down the governor absolutely. The trouble was remedied by the application of hot water. With these two exceptions we have had absolutely no trouble with the service governors. The same applies to the district governors. Mr. Parker, I think, touched upon an important point when he said that in laying additional high pressure mains they were going to increase the size of the pipe on account of its storage capacity. I think your legitimate storage tanks are your street mains. I believe it is better to put the extra money into a larger size of pipe rather than into the form of storage tanks. If your mains are laid properly there will be no leakage at all.

Mr. Lowe—I want to take issue on this question of increasing the size of the street mains for the sake of the additional storage capacity. If you will note the cost and capacity of one compression tank and compare them with the cost and increased capacity of a larger street main, you will never put in the street main. Twenty miles of 2-inch pipe will not have the capacity in cubic feet of one small compression tank. That is merely a guess. But you can easily figure it out and find how many 1,000 feet of 2-inch pipe it will take to give a capacity equal to that of one good compression tank costing say $300.

The Secretary—Twenty miles of 2-inch pipe has a capacity of about 2,500 cubic feet at atmosphere, which is equal to about 5½ such tanks as Mr. Lowe specified. It is my opinion they would cost more than $300, made or delivered in San Francisco, to withstand the pressure stated. I think, Mr. Lowe, that you have omitted one point. We are inclined to be carried away with the idea that high pressure is a panacea for all ills. It is true that by increasing the pressure at the works we can deliver an increased pressure at the far end of the line. And there is practically no limit to that; but the more rapid the flow, the greater the difference between initial and terminal pressure. In order to deliver a large amount you have to increase your initial pressure so much that you add a large expense to the compressor end of the proposition. The cost of compression runs up tremendously. I claim that it is better to put part of that expense into somewhat larger street mains and let them serve the double purpose of reducing the necessary initial pressure and of acting as a storage reservoir.

Mr. Lowe—What is to be your limit as to size? In a small town 2-inch pipe may be sufficiently large for all present purposes; but suppose the town grows to be 4 or 5 times as large as it is now, are you going to put down larger pipe?

The Secretary—Few towns increase 400 or 500 per cent. within the lifetime of ordinary wrought iron pipe; but if this should happen, then you must increase your initial pressure correspondingly. The question of size of pipe must be considered fully when you lay the mains. The same question arises in every engineering proposition. You must always look into the future and take a middle ground. I maintain that some of the high pressure plants have run into too small sizes of pipe.

Mr. Lowe—That is very likely true; but let us take San Francisco as an illustration. Suppose you were to run your lines of feeder mains toward the Pacific Ocean and the others across town, assuming that your gas works were at the bay side of town. The pipes running from block to block across the town, taking the gas from the feeding pipes and supplying it to the houses in any single block would not have to be more than ½ inch. This would be large enough for all the gas that could ever be used in an ordinary block, because the pipe is only carrying the gas a distance of one block from feeder to feeder. The feeders would naturally vary in size; but 50 per cent. of all the pipe might be almost the size of a lead pencil, as an extreme illustration; that is, with cubical contents amounting to almost nothing, with almost no storage capacity at all, yet having enormous delivering capacity.

Mr. Parker—Another reason for increasing the street mains from 1 to 2 inches was that we had difficulty in running ¾-inch services from 1-inch pipe. We used saddles for connecting, and the only difficulty we had in maintaining a tight line we found right there. We had no difficulties at all with the saddles on the 2-inch pipe.

Mr. Lowe—Why didn't you put tees in your pipe?

Mr. Parker—We didn't see fit to go to the expense of cutting the line in two every time we wanted to put in a service. We did not put in tees when we laid the pipe because sometimes there were no houses for 2 or 3 blocks. We could go back afterwards and put on a saddle.

The Secretary—The initial expense of putting in tees is trifling.

Mr. Lowe—There is no reason why you should not use a cast iron coupling instead of a saddle; a plain piece of cast iron like a sleeve, threaded.

Mr. Philo Jones—We laid about 8 miles of 2-inch pipe. While we found many vacant lots, we expect them to be occupied some day and we used 2 by 1 crosses and tees throughout the entire system. On our 3 and 4-inch pipe we use saddles.

Mr. Holberton—I have figured up some of Mr. Lowe's "guesses." His tank contains 471 cubic feet, and that is equivalent to only 4 miles of 2-inch pipe.

Mr. Quilty—What would the tank hold under compression?

Mr. Lowe—For every additional 15 pounds you put on you add the original capacity of the tank. If you have a tank holding 1,000 feet at atmospheric pressure and pump it up until the pressure is 30 pounds you have 2,000 feet. If you pump to 60 pounds you have 4,000 feet. Each additional 15 pounds pressure gives an additional unit.

Mr. Kuster—How will this system affect the consumer?

Mr. Colquhoun—We have had a greater satisfaction since using them than before. It is even better from the standpoint of the consumer than from the standpoint of the gas company.

Mr. Britton—It is not a question of increasing the pressure given the consumers. In San Francisco, for instance, the average pressure delivered would run from 6 to 8 inches. In a level town under ordinary conditions the pressure would be from 3 to 3½ inches. The high pressure system is designed to give the consumer only such a pressure as he would get in a perfect low pressure system. Gas appliances cannot be installed satisfactorily where the pressure is less than 3 inches. If it is 4 inches, so much the better. It will not cost the consumer as much to use a gas appliance at 6 inches pressure as it will at 2.

Mr. C. W. Eichbaum—I can remember when people were satisfied with 1¼-inch or 2-inch pressure. Recently we had, to our sorrow, one district where we could not get more than 2 inches pressure, and the complaints were something enormous, simply because the use of gas ranges had come in and the demand was such that a 4 or 5-inch pressure was just enough to give satisfaction, showing that the demand for pressure now is quite different from what it was 10 or 20 years ago.

Mr. Lowe—Do you mean 4 or 5 inches at the works?

Mr. Eichbaum—No; on the consumers' house pipes.

Mr. Osborn—It comes down to the fact that it takes so many heat units to boil a kettle. If you are at 20-tenths pressure it takes just so much longer for the neceesary amount to get out.

Mr. Eichbaum—They say that with a low pressure they cannot cook a dinner under 3 hours, while with a high pressure they can can cook it in ½ or ¾ of an hour.

Mr. Britton—We have here with us Mrs. Enloe, an honored guest, who ought to be a member of the Association. She has been demonstrating for the gas companies throughout the State, and really knows more about the effect of pressure than any gas engineer in the country does. I think she could interest you for a moment by giving you her experience.

Mrs. Enloe--I was very glad when this question of good pressure was brought up. It is impossible to bake biscuits where the pressure is very low. You can boil water slowly, but you cannot broil a steak and do it properly unless you do it quickly. I do not know how the pressure on the meter affects the bills of the consumer. I was wondering whether the bills were increased at all by high pressure. I did not know whether it was, as a lady said in Nevada city, "The gas goes through the meter fast." I certainly know, however, that unless the pressure is good you cannot use a gas stove to its best advantage. Where I have found the pressure the best I have been able to do the best work. We never find any complaints of a good, high pressure. It is always the low pressure that is complained of, where you cannot get gas enough to broil. The adjustment of the stoves should always be carefully looked after. In some places where the Bunsens were left wide open we got a small flame that did not give the best results. Where the Bunsens were closed more and there was a greater volume of flame the stoves baked much better.

Mr. Philo Jones—Several persons have spoken of high pressure at the service pipe, and have mentioned all the way from 2½ and 3 up to 7 and 8 inches. It is a question I am interested in because we have been experimenting with it at Salinas. I would like to know the proper pressure to give a consumer for gas appliances.

Mr. Osborn—Not less than 3 inches. You should adjust your Bunsens to the quality of the gas. When you get a thinner gas it strikes back; a richer gas gives a yellow flame. There must be a uniform grade of gas as well as a uniform pressure.

Mr. Lowe—Just one point in regard to the combustion of gas. It is not simply a question of the number of heat units that go into a loaf of bread. You might get 1 cubic foot of gas with a certain size of pipe under 1 inch of water pressure, and it may take 3 inches pressure on a small pipe to give you the same number of cubic feet of gas. The higher you go in your pressure, the smaller you drill your orifice and the greater the velocity of the issuing gas, the more oxygen you draw into it. You can burn 1 cubic foot of gas under low pressure and get very little result from it; you can burn that same cubic foot of gas by passing it through a small orifice, under high pressure drawing the air in and make it do greatly increased work.

Mr. Britton—As, for instance, in the blowpipe.

Mr. Lowe—Let it be understood that we are only copying to-day what the natural gas people have been doing for many years.

The Secretary—I would like to supplement Mr. Lowe's remarks in regard to cooking at high pressure. When you carry high pressure you are burning more gas, drawing in more air to the flame and producing a more violent combustion. You are generating a greater amount of heat in a short time. The loss by radiation is not so great. A given volume of gas might burn so slowly that the radiation would be just as great as the generation of heat. If you burn that gas as rapidly as possible without burning the food you get less loss by radiation. Take for illustration a barrel of water with a small hole in one side. Let the water flowing out of the hole represent your radiation. If you connect a pipe to the barrel to fill it up with water, the larger the inlet pipe the quicker you will overtake the loss due to the outflow from the hole in the barrel, and the quicker you will fill the barrel. The quicker you put your heat into the kettle, the quicker you will overtake the loss by radiation. It is, however, also possible to go to the other extreme and apply the heat more rapidly than the substance to be heated has the power of absorbing it, and thus a loss of heat may result from too much haste also.

Mr. Lowe—Let me tell you something. Suppose you take say 2 quarts of water, put it on a gas stove and bring the water to the boiling point in 15 minutes; then take the same quantity of water and reduce the time of boiling to 5 minutes; you will find that in boiling the water in 5 minutes you will burn at least 25 per cent. more gas. There is a very simple reason for this. Water has a heat absorbing ratio absolute and fixed. It has a most economical point of heat absorption. If you exceed that point you are driving away a great deal of heat. I have had a great deal of success in introducing gas stoves, and one of the little secrets has been in putting the gas stove on a par with the coal stove in some respects. If you put 2 quarts of water on a coal stove it will take 15 minutes to bring it to the boiling point. One of the advantages we generally claim for the gas stove is that it will do the work more quickly; but if you will increase the time of boiling of water as stated above, from 5 minutes to 15 minutes, you will save 25 per cent. of your gas. That is an absolute fact. It is not economy to cook too rapidly. On the other hand, if you pass a certain point and cook too slowly, then the loss of heat is just as the Secretary explained it; but if you go too fast you are heating the atmosphere instead of cooking the water. Of course, you must cook within a reasonable time, as people have been accustomed to cooking within a certain time limit. But we are charging them on the basis of the gas consumed, and everything we can do for them within reason, to cheapen the cost, is the best for us.

Mr. Osborn (of Woodland)—I would like to give a little of our experience in Woodland in regard to gas stoves; particularly as to high bills on account of poor pressure. Woodland is an old gas town. We have there some old gas mains and some services in certain sections that are not up to the mark. I notice that where we get complaints of bad pressure the people have the highest gas bills, and that they are the people who are always complaining. Where we have a certain number of complaints in a month we dread to see the people come in for their bills for we know they will be high. It is something, of course, that we are trying to remove as much as possible. We realize that with a good uniform pressure of 3 inches the bills will be uniform and there will never be any complaints about the service.

On motion of Mr. Aldrich a hearty vote of thanks was passed to Mr. Britton for his paper. (To be Continued.)

## Oil and Tar Burning on the Pacific Coast.

By "An Exile."

*Some Burning Devices Illustrated.*—Your correspondent recently visited and inspected some of the oil burning and tar burning plants of California, a description of which may be interesting to oil and tar men. Oil and tar burning in that State has not been in use for many years, except on a small scale, and nearly all of the apparatus now in service is of new design. At one works where they are burning oil of a very cheap grade for bench work in manufacturing and machinery departments of large works, the furnaces and generators of the benches are filled with ashes, and the openings on top of the generators are covered with a tile device which is effective in its work. These precautions are taken to prevent explosions which are occurring in some shops where they are careless in the use of oil for burning for bench work. Standard burners are used, fitted with the necessary attachments for combining the air, oil and liquid tar to best advantage. The oil used is pumped from the storage tanks just outside the works into tanks which are arranged over the benches. This gives the required pressure to the oil and facilitates the work. An air supply of about 18 inches water pressure is applied. With light oil, in this arrangement, a good, even heat is sustained at the benches, and one man is able to regulate a considerable number of fires. In cold countries, it would be necessary to heat the oil in the tanks with a coil of pipe, but in this climate there is no need of artificial heating. The light grades of water gas tar can be utilized to advantage in this device.

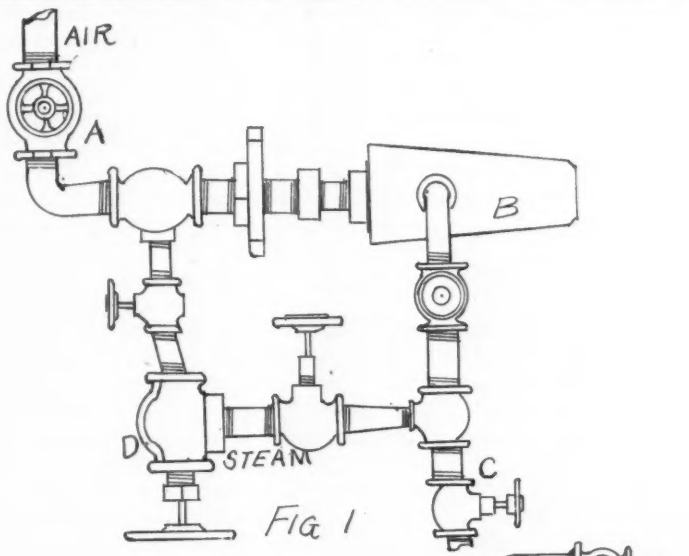
*Burners.*—There are various descriptions of burners in use in the oil and tar burning plants of California, and from personal observation I am inclined to believe that some of these burners are quite original in design. I saw some of different pattern from any seen in the East. There are some ingenious persons here on the Coast who are experimenting extensively with burners for making the oil supplies of the country more popular, by its large use in bench work and other lines of work aside from power developing and heating. In Fig. 1 is shown a plan of a burner which is of Western design, and which has been used advantageously at both bench work and in power development. In this burner steam is also employed. The air is received into the device through the upper pipe in which there is a valve, *A*, as presented. This valve must be of good design, tight and reliable. It will not do to use a poor form of valve here as it will leak. I saw that they were experimenting with a device of this pattern, and the air valve which was employed leaked badly, so that there was no effective means for regulating the charges of air or of shutting off the air supply entirely when so desired. The dome, *B*, is employed for a retort for the air and surplus steam. The steam valve is at *D*, and the steam charges are received into it by means of a pipe joined in on the opposite side. The outlet for the combined air, steam and oil is at *C*. Just above the outlet on the other side, and not shown in the front view of the cut, is the valve with piping employed for letting in the oil or tar, whichever the case may be. The oil is drawn from tanks about 12 feet above the level of the inlet piping, so that ample force is obtained. If tar is used, the same arrangements of piping are utilized.

*Simple Form of Burner.*—I also saw some very simple patterns of burners in use, such as presented in Fig. 2. This is a sectional view and the plan can be readily outlined. The air is passed in through one of the *F* pipes, while through the other *F* pipe steam is drawn if required.

In Fig. 3 is a design of burner made and used at an iron works in San Francisco. There is a central cylinder inside of a metal chest, and inside of this cylinder is a piston and valve for controlling the charges of oil. The interior of this cylinder is marked *G*. The pipe through which the mixed air and oil is drawn is marked *H*. The oil, with sometimes tar, is admitted through either the upper or lower pipe connections, which are fitted above and below to the main chest.

*Form of California Nozzle.*—Although some of the users of oils and tars in power raising and heating and bench work in the State of California are not quite so far advanced in the use of modern devices as the users of oils and tars for this line of operations in the Eastern and Middle States, it was my experience to note that some of the Californians had invented some pretty good devices for use in this line of work. Take, for instance, the nozzles used in delivering the oil charges to the steam or air chambers for mixing. Often the interior forms of these nozzles are so arranged as to retard the movement of the flow. Again, the nozzle being full open from end to end, no adequate means are afforded for controlling the charges and miscellaneous pressure of liquid results. The feed being uneven, the resulting work is poor and unreliable. To overcome this defect, a California oil man has introduced nozzles of the pattern shown in Fig. 4. The opening into the nozzle is, as can be seen, full and free. The outlet is the same. The middle course of the nozzle, however, is depressed by the center being gradually reduced in diameter. If this reduction in proportions were not made on scientific lines it would be worse than not having it at all; but if it is correctly designed and properly smoothed for the flow of the oil, tar, air or steam, the resulting charges are more likely to be under control and uniform than when smooth and straight bores are used. The reduced portion tends to twirl the stream which passes through, and, checking it for a little, causing it to expand as soon as released in the more open portion near the outlet. The letter *I* designates the arrow, and its direction shows the course of flow of contents.

*Some Defectively Planned Oil Pipes and Unions.*—In some of the California plants in which oil, tars and other liquids are burned for power developing, heating or bench work, I observed various serious defects. In one place I saw that the old-time mistake of entering a charging pipe into a chamber or globes was made, as shown in Fig. 5. In this illustration, the sectional drawing shows the plan of the globe on the interior, and the charge of oil, tar, steam or air enters straight out into *B* through pipe *A*, contacting with force against the opposite, interior side of the globe. When steam and air are thus introduced into a space chamber, where the chances for getting a hard, frictional contact with the metal are good, as in this case, the metal is very liable to become worn thin in a comparatively short time. If oil is thus forced into the chamber and against the metal wall, the chances for the wearing of the metal are excellent, and in a year or two a new part




Some California Designs of Oil and Tar Burners.

is needed. If the charges are of the tarry sort, the work of a few months may be sufficient to accomplish the ruin of the globe. Introductory charges of air, steam, oil, tar or other ingredients should not be permitted to enter a chamber in this manner. The pipe which enters the globe should be inclined in such way as to cause the charges to strike at an angle, thus giving the same a chance to glide swiftly over the walls instead of striking them direct.

*Trouble at the Oil Wells from Defective Placing of Pipes.*—In my travels about the new oil-well diggings of the State of California, as might be expected in a new field, I found that the parties owning the lands and wells were frequently obliged to do their own work or employ inexperienced men. There are, of course, trained oil well workers in the State, and they are doing much good for the proprietors of newly discovered oil regions; but there are not many expert pipe fitters available. In the first place, the pipe fitters of the State are not properly equipped with oil pipes, oil valves, hydrants, thread cutting and adjusting devices, and if you call at some of the leading steam and water pipe fitting engineers' offices of the country you will be told that there are no special arrangements made for oil pipe fittings. I was informed by some of the pipe men that they were not aware that full assortments of oil pipe fittings could be purchased in New York and other large Eastern cities. Others did not even know that there were concerns in the United States who were making a specialty of oil pipes and oil valves. It was supposed that the so-called oil pipe furnishings were merely pipes and fittings of water, gas or steam manufacture and

altered a little, perhaps, and called oil furnishings; but, as is known to the oil well people of Pennsylvania and other oil producing sections of the country, oil pipes and fittings specially designed and made for the purpose can be procured the same as water, steam or gas pipes. I found in some of the new oil well regions of this State, straight pipes running oil into tanks on the plan shown presented in Fig. 6. Of course, the constant action of the charge of oil on the woodwork at *C* soon wore a thin place and finally a hole through the wood. In some cases, metal tanks were seen in service, and the point where the pipe entered the oil charge was turned as at *D*, Fig. 7, thus throwing the oil up and greatly relieving the situation. But the trouble in this respect is usually that the curve to the metal sheathing is not as much as it ought to be, and eventually wearing off of the metal is observed, which if not rectified, will result in a fracture in the spot in time. The best way is to have a full, long curve like *E*, Fig. 8. In this formation we get such a long plane over which the frictional action of the charge of oil is distributed that there is practically no wear of the metal.

*Not up in Pipe Bending.*—It was also the experience of your correspondent to observe that some of the pipe fitters for the oil wells and springs of California were not quite up to the tricks of pipe bending. It cannot be expected that the all-around machinist of the oil producing plant can be qualified as a pipe fitter, and yet in many cases the only men I found concerned in the piping systems of the oil plant were the home machinists. The result was that at many of these places I saw some pipes in pretty bad order. I recollect seeing some which had been bent about angles to get into different shafts or to reach certain points at different angles, and in making these bends the pipes were evidently bended over a straight object, resulting in an angle pretty much like that presented in Fig. 9. There is the familiar depression in the pipe wall at *F*. This not only checks the flow of oil, thus making the pipe practically about half as small in capacity, but this depression forms a place on the interior of the pipe which will catch obstacles and finally stop the flow of the channel and create endless trouble. The proper mode of bending these pipes is to fill the interior with clay, putty or rosin. Then bend them over a form, cold. If you have an iron form, then the pipe can be bent hot, without interior packing, but it is best to bend cold with a filling which will surely prevent the walls caving in. After the walls are once put out of condition by sinking in, it is very difficult to restore them. The pipe must be heated and slid over a mandrel, and then, by carefully using the hammer, the indented places can be brought up into line and the pipe made clear and smooth on the inside. There is a very good opening for men at the oil wells of California who are familiar with putting in proper piping systems for flowing oil to tanks or for utilizing oil for the cylinders of power devices or for bench work. There is also a lively market for oil pipes and fittings.

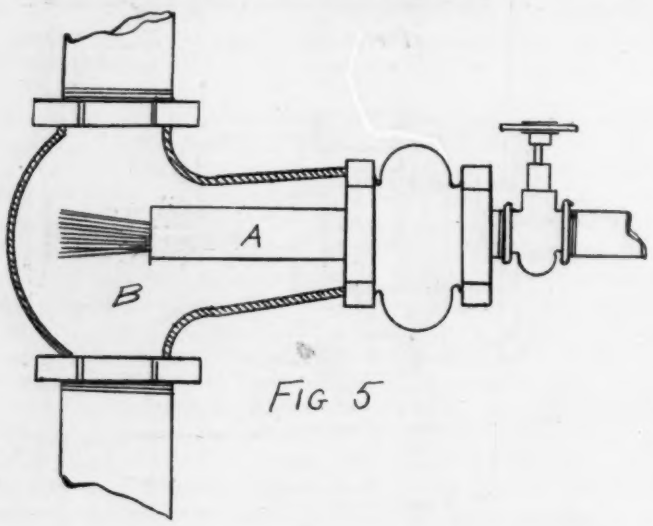


FIG 5

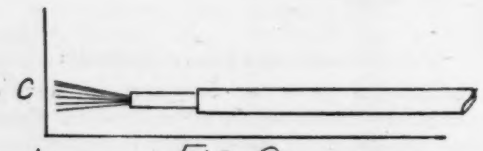


FIG 6

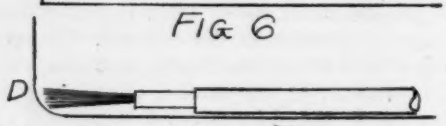


FIG 7

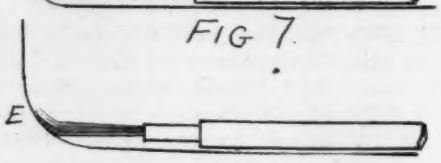


FIG 8

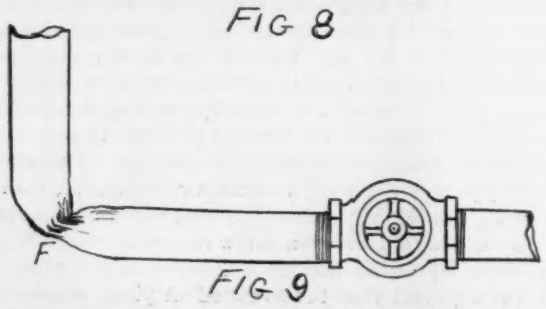


FIG 9

Points on Using Oil Pipes and Connections in Californian Oil Burning Plants.

[Continued from page 409.]

## Variations in the Lighting Power in the Incandescent Burner of Combustible Gases.

By E. Sainte-Claire Deville.

[Abstract translation in *Journal of Gas Lighting* of a paper presented to the International Photometric Committee.]

In reference to the important question of the theoretical temperature of combustion of coal gas, let it be stated that, from the nature of the case, it must fall within very narrow limits, and this without any regular connection between the richness of the gas and the maximum temperature of combustion. This will be obvious on studying the combustion of rich and poor gas; the methane of poor gases being replaced by the light-giving hydrocarbons of rich gases. Carbon monoxide, too, is nearly constant in amount in rich and poor gas alike, and the final result is that theoretically the maximum temperature is about 1,950° C. for all qualities. Here, then, is an apparent paradox: Poor gas gives a flame which, theoretically, is no hotter than that of rich gas, but nevertheless raises the mantle to a distinctly higher temperature than does rich gas. The explanatien lies in the fact that the mixture of air and gas reaching the mantle *is not rich enough in air for complete combustion*. The gas escapes very rapidly from the meshes of the mantle, pushing back the outside air. Whatever aid the latter gives to the complete combustion is too late; the action takes place outside the mantle. The mantle's maximum temperature is fixed by that of the gas passing through its meshes; and, reasoning from its chemical composition, the temperature of the gas is limited by the tension of dissociation of its products of combustion. This limit I have found to be higher for poor gas than for rich; the products of rich gas, which contain a larger proportion of carbon dioxide, being more easily dissociable than those of poor gas. A direct experiment leaves no doubt as to the facts of the case. A No. 1 burner was fed with rich gas, and the maximum lighting power proved to be no higher than 20.4 carcels, however the air and gas were adjusted to it. This figure ascertained, a slight touch to the taps delivered a poor gas to the burner, and the lighting power *at once* rose to 27 carcels on adjusting the air and gas.

Referring now to Table I. and Diagram 1, it will be seen that up to an absolute production equal to about 800 calories per hour the light per 1,000 calories rises rapidly with the consumption, but differs less for poor gas than for rich—that is to say, the proportion of incandescent power to heat of combustion observed in 1894 up to 400 calories per hour holds good up to 800 calories. The proportion of air admitted to the base of the burner increases also, but finally remains between fixed limits. from which it cannot escape.

383 liters for 100 liters of poor gas beyond 1,150 calories.
618 " " rich " 850 "

There is also a point at which the intensity per 1,000 calories stops, and at which also the proportion of air attains its maximum. This point is characterized by the following figures:

| | Poor Gas. | Rich Gas. |
|---|---|---|
| Maximum proportion of air to 100 volumes of gas.. | 383 | 618 |
| Calories produced ..... | 1,000 | 900 |
| Gas consumed (liters)..... | 245.60 | 141.80 |
| Absolute intensity (carcels)..... | 18.62 | 15.57 |
| Maximum intensity: Per 1,000 calories..... | 18.62 | 17.30 |
| " " Per 100 liters of gas..... | 7.58 | 10.98 |
| Minimum consumption of gas per carcel (liters).... | 13.19 | 9.11 |

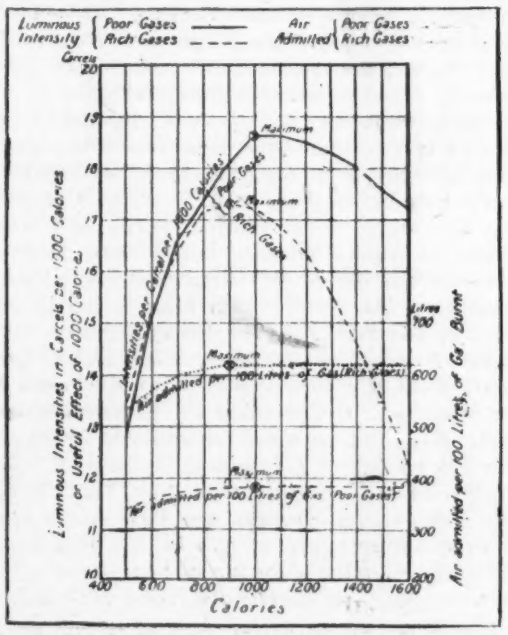



**Diagram I.**—Showing the Variations in Luminous Intensity, in Carcels, per 1,000 Calories, and in the Proportion of Air Admitted per 100 Liters of Gas Burnt, in Function of the Heat Expenditure per Hour.

Phase No. 2 (transitional) corresponds to the progressive increase of heat from 500 to 900 calories for rich gas, and from 500 to 1,000 calories for poor gas. During this phase, *an increased proportion of air* must be admitted to the base of the burner for maximum intensity. This increase is necessary to *keep the dimensions of the flame equal to the interior of the mantle.* The outside air takes less part, and the usefulness of a chimney is less. At the limit of this phase—*i. e.*, 900 calories for rich gas and 1,000 calories for poor gas—the maximum luminous effect is:

| | Rich Gas. | Poor Gas. |
|---|---|---|
| Intensity per 1,000 calories (carcels)..... | 17.30 | 18.60 |
| " " 100 liters of gas (carcels)..... | 10.98 | 7.58 |
| Or consumption per carcel (liters)..... | 9.10 | 13.20 |

Phase No. 3 (900 to 1,400 calories for rich gas, 1,000 to 1,600 for poor gas). If the increase in the consumption of gas is carried still further, it is found that, the proportion of air remaining constant and not passing the limit already indicated, the *absolute luminous intensity continues to increase.* This proves that at the end of the second phase the hot gases projected on to the mantle are not moving rapidly enough to make good the loss by radiation, and to keep the mantle at their own temperature. Now, however, that these same gases are being supplied in greater and greater excess, a point is reached at which an increase in speed no longer produces an increase in the intensity of the light. The mantle is now in equilibrium with the flame as regards temperature, and has reached the absolute maximum compatible with the composition of the gas. For rich gases, the maximum intensity is found to be

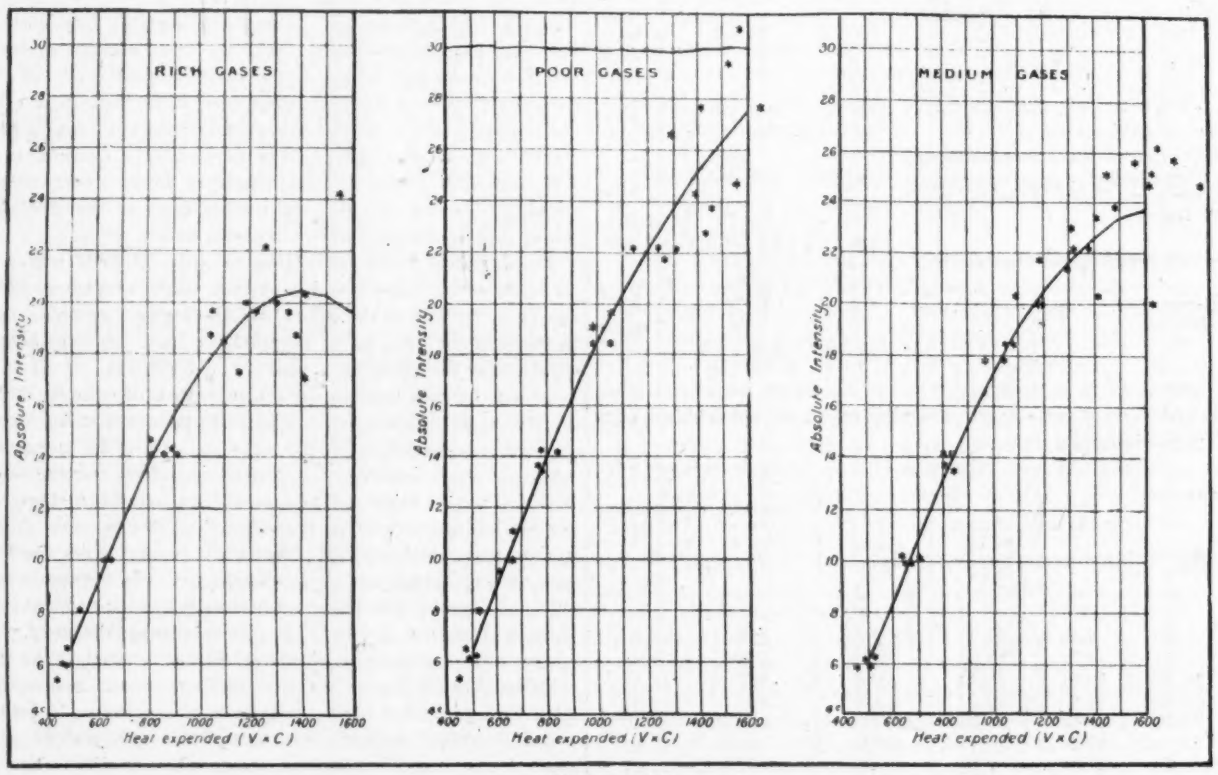



**Diagram II.**

If one increases the gas consumption after this point, the absolute intensity increases further, but in a diminished proportion to the consumption. We can divide what happens when the consumption is increased from 350 calories per hour to the limiting amount of 1,600 calories in three phases; still taking the case of a No. 1 Welsbach burner, with adjustable air supply.

During phase No. 1 (low hourly consumption of from 350 to 500 calories), the proportion of air to the burner must be kept low, because, as the gaseous mixture moves slowly in the tube, lighting back can take place (especially with poor gases), if the mixture is too explosive; also because, if the mixture is too rich in air, the flame will be too short, and only the lower part of the mantle will be ignited. Under these conditions, combustion is complete on contact with the outside air; and the employment of a chimney in these instances of low consumption is justified. The heat supplied, per unit of time, to the mantle is quite insufficient to compensate for the loss by radiation; so that the mantle remains at a temperature much below the theoretical. The light per 1,000 calories is practically constant for different gases; and hence the light per 100 liters of gas is proportional to the actual heat of combustion of the gas.

for a production of 1,400 calories per hour, and does not exceed 1.7 carcels per square centimeter. For poor gases. it is at 1,600 calories, and reaches 2.3 carcels per square centimeter. The difference seems to be due to the fact that the limiting influence of the dissociation phenomena on the temperature of the flame *is greater for rich gas than for poor.* During the third phase, the increase of intensity is no longer so rapid as the increase in consumption. The intensity per 100 liters of gas diminishes steadily; but, nevertheless, the excess of consumption gives some result in intensity. Beyond this—that is, when the absolute maximum intensity has been reached—all further increase is pure loss.

Taking as abscissæ the quantities of heat produced (V × C), we draw ordinates proportional to the absolute intensities successively observed with the five mantles used with rich gas. We thus obtain a kind of bundle of somewhat divergent points starting from 800 to 900 calories.[1] We trace the average line of the area thus marked out, and let fall upon it the height of the ordinates or intensities corresponding to the values V × C, equal to 500, 600 * * * 1,600 calories. By applying this method also to the five medium and five poor gases, we have

1. The figures placed against certain points signify that the same value has been obtained in two or three different experiments.

determined the figures in the columns "Consumption per Hour" and "Absolute Intensity" in Table I. for poor and rich gas, as is done also in the next table for medium gases.

TABLE II.

| | Means | | |
|---|---|---|---|
| | For Five Rich Gases. | For Five Medium Gases. | For Five Poor Gases. |
| *Experimental Data.* | | | |
| Lighting power (gas at 10° C. and 760 mm. per carcel) (liters) | 76.62 | 103.47 | 288.80 |
| Density (dry gas at 0° C. and 760 mm.) | 0.5344 | 0.3951 | 0.3161 |
| Composition by volume— | | | |
| Benzene vapor | 1.346 | 1.138 | 0.770 |
| Propylene | 2.912 | 0.972 | .... |
| Ethylene | 3.782 | 2.188 | 0.624 |
| Methane | 44.066 | 31.410 | 23.878 |
| Hydrogen | 36.560 | 53.820 | 64.642 |
| Carbonic oxide | 7.280 | 7.228 | 7.252 |
| Carbon dioxide | 2.654 | 1.844 | 1.434 |
| Nitrogen | 1.000 | 1.000 | 1.100 |
| Oxygen | 0.400 | 0.400 | 0.400 |
| | 100.000 | 100.000 | 100.000 |
| Heat of combustion (Junkers calorimeter) Water condensed, calories | 6,912.20 | 5,616.60 | 4,475.20 |
| Constant pressure per cubic meter at 10° C. and 760 mm. Water as steam | 6,346.20 | 5,121.60 | 4,017.80 |
| Calories (water as steam) per 100 calories (kilo.) (water condensed) | 91.79 | 91 18 | 90.06 |
| *Data by Calculation.* | | | |
| Heat of combustion per dry cubic meter of gas at 0° C. and 760 mm. (calories). | 6,670.40 | 5,292.40 | 4,353 40 |
| Temperature of combustion | 1,950° C. | 1,952° C. | 1,949° C. |
| Volume of air for complete combustion of 100 liters of gas | 1,695.30 | 542.20 | 439.30 |
| Volume of products of combustion of 100 liters of gas | 774.90 | 612.20 | 503.10 |
| | Per Cent. | Per Cent. | Per Cent. |
| Composition of products of combustion— | | | |
| Nitrogen | 71.17 | 69.29 | 69.34 |
| Water vapor | 18.72 | 20.78 | 23.03 |
| Carbon dioxide | 10.11 | 9.93 | 7.63 |
| | 100.00 | 100.00 | 100.00 |

The other columns of these tables are obtained by simple calculations from the two fundamental data.

| Hourly Consump ion. | | Light in Carcels. | | | Volume of Air for 100 Liters of Gas. | Consumption of Gas per Carcel. Liters. |
|---|---|---|---|---|---|---|
| Calories. | Liters of Gas | Absolute. | Per 1,000 Calories per Hour. | Per 100 Liters of Gas. | | |
| 500 | 97.80 | 6.10 | 12.20 | 6.250 | 430 | 16.00 |
| 600 | 117.15 | 8.38 | 13.96 | 7.153 | 445 | 13.98 |
| 700 | 136.70 | 10.81 | 15.44 | 7.909 | 470 | 12.64 |
| 800 | 156.20 | 13.23 | 16.54 | 8.470 | 475 | 11.81 |
| 900 | 175.70 | 15.33 | 17.03 | 8.724 | 480 | 11.46 |
| 1,000 | 195.30 | 17.26 | 17.26 | 8.840 | 485 | 11.31 |
| 1,100 | 214.80 | 19.06 | 17.33 | 8.874 | 489 | 11.27 |
| 1,200 | 234.30 | 20.48 | 17.02 | 8.715 | 489 | 11.47 |
| 1,300 | 253.80 | 21.62 | 16.63 | 8.518 | 489 | 11.74 |
| 1,400 | 273.40 | 22.60 | 16.14 | 8.279 | 489 | 12.08 |
| 1,500 | 292.90 | 23.37 | 15.58 | 7.979 | 489 | 12.53 |
| 1,600 | 312.40 | 23.70 | 14.81 | 7.584 | 489 | 13.18 |

## Production of Coke in 1902.

WASHINGTON, D. C., September 8, 1903.—The production of coke in the United States during the year 1902 exceeded that of any previous year by more than 16 per cent., according to the annual report of the United States Geological Survey, which has just been completed by Edward W. Parker. What is known as "gas house coke," which is a by-product in the manufacture of illuminating gas, is not considered in this report.

Until 1893 practically all of the coke made in the United States was the product of what is commonly known as the beehive oven. During the last decade, however, there has been a steady and noteworthy development of coke manufacture in retort or by-product ovens, which, if continued, will cause the gradual shifting of the coke making industry from the vicinity of the coal mines to the manufacturing centers, where markets for by-products are available. Although in some instances the coke product from these retort ovens is a secondary and not the primary product, the manufacture of such coke is considered as properly coming within the scope of this investigation.

The coal consumed in the manufacture of coke in the United States is drawn from six of the seven bituminous coal fields—namely: 1. The Appalachian field, embracing the great coking coal regions of Pennsylvania, Virginia, West Virginia, Ohio, Georgia, Alabama, Tennessee and Eastern Kentucky. 2. The Eastern interior field, which includes the coal areas of Illinois, Indiana and Western Kentucky. 3. The Western interior field, embracing the States of Iowa, Kansas, Missouri and Nebraska. 4. The Southwestern field, including Arkansas, the Indian Territory and Texas. 5. The Rocky Mountain field, including Colorado, New Mexico, Utah, Montana, South Dakota and Wyoming. 6. The Pacific Coast field, in which the only coking coals are found in the State of Washington. The coal of the Northern interior field, lying wholly within Michigan, has not so far been used for coke.

A considerable amount of coke is made in States in which there are no coal fields—namely, Massachusetts, New York, New Jersey and Wisconsin. The ovens in Michigan and those under construction in Maryland near Baltimcre are, or will be, fed with coal from other States. With the exception of the few beehive ovens in Wisconsin, all of the plants outside of the coking coal fields are retort ovens. The unit of measurement used in this report is uniformly the short ton of 2,000 pounds.

The production of coke in the United States in 1902 amounted to 25,401,730 short tons, as compared with 21,795,883 short tons in 1901. Large as this increase was, it was considerably less than it would have been had the transportation facilities been commensurate with the demand for coke and with the productive capacity of the ovens. During the greater part of the year operators were kept at a disadvantage by the inability of the railroads to supply cars and motive power to handle the output. The condition was particularly evident in the Connellsville region of Pennsylvania, where at times it was necessary to put a number of ovens out of blast on account of the accumulated stocks, which overtaxed the storage capacity at the ovens.

The unprecedented production of coke in 1902 was accompanied by an increase in value which was even more worthy of note. The average price per ton at the ovens was the highest recorded in a period of 23 years, and the total value reached the high figure of $63,339,167, an increase over the preceding year of $18,893,244, or 42.5 per cent. The value of the coal used in the manufacture of coke in 1902 exceeded that of 1901 by $7,922,563, from which it appears that the value of the coke product increased $10,970,681 over and above the increased value of the coal used in its production. Prices for coke during the strike in the anthracite coal fields reached an abnormally high stage, as much as $15 per ton being reported as paid for this fuel at one time. In 1901 the highest price obtained for Connellsville furnace coke was $4.25, which was paid during March and April of that year. In September and October of 1902, while contract coke was nominally quoted at $3 per ton, consumers were paying from $10 to $12 per ton for prompt delivery. With the termination of the anthracite strike in the latter part of October prices for coke quickly declined, but they did not reach the comparatively low level that prevailed in the early part of the year. In December furnace coke for prompt delivery was commanding $5 and $6 per ton, and contracts for delivery in the first six months of 1903 were made at from $3.75 to $4 per ton. These prices showed a decided advance over December, 1901, and January, 1902, when contracts for Connellsville furnace coke were made at $2.25 per ton, coke for prompt delivery bringing $3.50 and $3.75 per ton.

In considering the total value and average price for the entire coke product of the United States as presented in this report, it must be remembered that in many cases the values are arbitrarily fixed. A number of the larger manufacturers operate blast furnaces in connection with their coal mining and coke making business. In such cases the coke product is sometimes charged against the furnace departments at cost, and sometimes at a figure, based upon the cost of coal mining and coke making, plus a percentage of profit on these operations. The value is not fixed by the market value. In other cases the value is estimated upon the averaged prices for coke of a similar quality produced and sold in the immediate vicinity. The H. C. Frick Coke Company, of Pittsburg, the largest single producer of coke in the United States, is now no longer in the market as a seller of coke, its entire product being taken by the United States Steel Corporation, of which the Frick Company is a component part.

During 1902 there were 69,069 coke ovens in existence in the United States, as compared with 63,951 ovens in 1901. Of these 69,069 ovens

1,945 were idle throughout the entire year, leaving a total of 67,124 active ovens, which produced an average of 378.4 tons per oven. The total number in 1902 included 1,663 by-product recovery ovens, which produced 1,403,588 tons of coke, an average of 844 tons of coke per oven. There were under construction at the close of 1902, 8,758 new ovens, of which 1,346 were of the retort or by-product type. The number of completed retort ovens increased from 1,165 in 1901 to 1,663 in 1902, and the output of retort oven coke increased during the same period from 1,179,900 tons to 1,403,588 tons.

Counting each bank of ovens as a separate establishment, the returns for 1902 show a total of 456 establishments, as compared with 423 in 1901. Thirty-five establishments, all comparatively unimportant, were idle throughout the year. There were also 29 new establishments whose ovens were not completed at the close of 1902.

The details of the production of coke in 1902 are presented by States and Territories in the following table:

| State or Territory. | Establishments. | Coal Used. Short Tons. | Coke Produced. Short Tons. | Value of Coke Per Ton. |
|---|---|---|---|---|
| Alabama | 37 | 4,237,491 | 2,552,246 | $3.25 |
| Colorado* | 15 | 1,695,188 | 1,003,393 | 2.74 |
| Georgia | 2 | 129,642 | 82,064 | 3.643 |
| Indian Territory | 4 | 110,934 | 49,441 | 4.10 |
| Kansas | 10 | 35,827 | 20,902 | 2.617 |
| Kentucky | 7 | 265,121 | 126,879 | 2.505 |
| Maryland | 1 | ..... | ..... | .... |
| Missouri | 2 | 10,430 | 5,780 | 2.50 |
| Montana | 3 | 99,628 | 53,463 | 6.75 |
| New Jersey | 1 | ..... | ..... | .... |
| New Mexico | 2 | 40,943 | 23,296 | 3.178 |
| Ohio | 9 | 219,401 | 146,099 | 3.37 |
| Pennsylvania | 196 | 25,017,326 | 16,497,910 | 2.33 |
| Tennessee | 15 | 1,025,864 | 560,006 | 2.85 |
| Utah† | 2 | ..... | ..... | .... |
| Virginia | 14 | 1,716,110 | 1,124,572 | 2.065 |
| Washington | 5 | 68,546 | 40,305 | 4.94 |
| West Virginia | 120 | 4,078,579 | 2,516,505 | 2.318 |
| Illinois | 3 | | | |
| Indiana | 1 | | | |
| Massachusetts | 1 | | | |
| Michigan | 2 | 852,977 | 589,869 | 3.446 |
| New York | 2 | | | |
| Wisconsin | 1 | | | |
| Wyoming | 1 | | | |
| Totals | 456 | 39,604,007 | 25,401,730 | $2.49 |

* Includes the production of Utah. † Included with Colorado.

The earliest record of coke production in the United States was that made during the census year of 1880. In that year the total production amounted to 3,338,300 short tons. Previous to this most of the iron manufactured in the United States had been made with the use of anthracite coal. Since 1880 the increase in production and use of coke has rapidly supplanted the use of anthracite coal for iron making, and now little of our large iron tonnage is produced in anthracite furnaces. A comprehensive idea of the growth of the coking industry in the United States is obtained by dividing the history of the last 20 years into 5-year periods. The average production for the 3 years, 1880 to 1882, was about 4,000,000 tons a year. In the 5 years from 1883 to 1887, inclusive, the average production amounted to 5,980,449 short tons. The average for the next 5 years, from 1888 to 1892, was nearly double that of the preceding 5 years, amounting to 10,533,918 tons. This period was followed by the panic years of 1893, 1894 and 1895, and the coke production showed only a small increase in the next 5 years, averaging during that time 11,418,536 tons per year. The return of prosperous conditions, which began in 1896, has shown no decided setback since that time, and the production of coke during the 5 years from 1898 to 1902, inclusive, obtained an average of 20,689,347 tons, and exceeded for the first time a total of 25,000,000 in 1902.

The 456 establishments which were in existence on December 31, 1902, included 29, with a total of 4,878 ovens, which were not entirely completed before the close of the year and did not contribute to the production in 1902. There were also 35 establishments, having a total of 1,539 ovens, whose ovens were not operated at all during the entire year. These idle plants were all comparatively small, averaging only 44 ovens to the establishment.

In view of the fact that approximately two-thirds of the entire coke product of the United States is made in Pennsylvania, some of the details of the industry in that State will be of interest. Sixty per cent. of Pennsylvania's product, or 40 per cent. of the entire output of the United States, is from the famous Connellsville region. In 1902 the coke production of Pennsylvania amounted to 16,497,910 short tons, out of a total for the United States of 25,401,730 tons. In 1901 Pennsylvania produced 14,355,917 tons, out of a total of 21,795,883. Of these totals, the Connellsville region produced, in 1901, 10,235,943 tons, and in 1902, 10,418,366 tons. To this production of the Connellsville region might be reasonably added the output of the recently developed areas in the vicinity of Uniontown, which have been classified in this report under the name of the Lower Connellsville district. This new district produced in 1901, 1,116,379 short tons, and in 1902, 1,899,111 tons, making the total for the two districts in 1901, 11,352,322, and in 1902, 12,317,477 short tons.

There were in 1902 196 establishments in the State, as compared with 188 in 1901. Four of the 8 new plants were constructed in the Lower Connellsville district, the most recently developed coking field in the State, the total number of completed ovens increasing from 34,906 to 90,609. Of this increase 1,002 were in the Lower Connellsville district. There were building at the close of 1902 2,332 new ovens, as compared with 832 ovens in the course of construction at the close of 1901. The completed ovens at the close of 1902 included 507 Otto-Hoffman, 75 Semet-Solvay and 8 Newton-Chambers by-product ovens. Of the 2,332 ovens building at the close of 1902 there were 100 Otto-Hoffman, 100 Semet-Solvay and 212 Schniewind by-product ovens. Including the ovens which were completed in 1902, but not completed in time to be put in blast during that year, there were 9 establishments in the State, with a total of 599 ovens, which did not produce any coke throughout the entire year.

The retort or by-product method of coke making in the United States continues to show encouraging progress. This is principally evident in the number of new plants which have been reported as in course of construction at the close of the last 3 years. It should be remembered that the construction of one of these plants involves a much larger expenditure of capital and consumes a much longer time in the actual building than is necessary for the completion of a beehive oven plant. The close of 1902 marks the completion of the first decade of the use of by-product ovens in the United States, the first plant having been constructed at Syracuse, N. Y., in 1893. This plant, which was largely experimental, consisted of but 12 ovens. At the close of 1902 there had been completed a total of 1,663 by-product coke ovens, and 1,346 ovens were in course of construction.

The statistics gathered by the survey show that at the close of 1900 there were 1,096 ovens building, of which barely 50 per cent. had been completed at the end of 1902, showing an average of more than 2 years consumed in the building of these plants. The amount of coke produced in by-product ovens in 1902 amounted to 1,403,588 short tons, or 5.52 per cent. of the total product, as against 1,179,900 tons, or 5.44 per cent. of the total, in 1901. The average annual production of by-product ovens amounted to about 1,000 tons of coke each, while the highest average attained for each beehive oven in any year was made in 1902, when it reached 366.6 tons. W. L. C., in *Iron Age*.

## Electric Plant Failures: Their Origin and Prevention.

In a paper on this subject, read by Mr. A. C. Cormack, before the British Institution of Mining Engineers, the author said: The three tables given herewith represent an analysis of the breakdowns which have occurred during the past 4 years to several thousand motors and dynamos, ranging in size from ½-horse power (motor) to 800 kw. (dynamo). The machines included in these statistics work under conditions of attention and superintendence which are somewhat better than the average, and since a number of very bad machines have been left out of the count, the figures must be taken to be considerably above the average. Motors driving coal cutting machines have not been included, as the statistics from these are far from complete.

Table I. summarizes the nature of the accidents. When several parts were injured in a single breakdown, each is included in the table, excepting in those cases where the failure of one part is certain to follow on the failure of another. The points of origin of the different breakdowns are shown in Table II., and Table III. gives a summary of the ultimate causes of the failures. The per cents. in all cases refer to the total number of failures covered by the tables. The preparation of these tables has been somewhat complicated by the complex nature of some of the derangements. In some cases, the derangements were not caused by any single fault, and for this reason in preparing Table III. it was necessary to adopt a system of marks allocating the same number to each breakdown, but distributing them if more than one fault was the cause of breakdown.

Of the accidents in which the field magnet coils were damaged (Table I.), the larger number were cases in which the insulation between the coil and coil former or cores had given way. The 1.56 per cent. representing coils gone altogether—that is, arcing from series to

shunt on the same coil or arcing between two separate coils—show that this is not altogether an uncommon accident. The latter accident is most frequently met with in bipolar machines, where the coils often touch. In this case, unless the outer layers are at the same potential, there is considerable risk of accident.

TABLE I.—*Relative Frequency with which Various Portions of Dynamos and Electric Motors were Damaged in Breakdowns.*

| | Per Cent. |
|---|---|
| Mechanical portions— | |
| Broken shafts | 2.35 |
| Binders and fasteners | 9.40 |
| Bearings | 8.60 |
| Other mechanical parts | 4.70—25.05 |
| Brush-gear, connections, terminals, etc.— | |
| Failure of brush insulation | 2.35 |
| Connections and terminals | 3.10 |
| Mechanical portion of brush-gear | 1.56— 7.01 |
| Field magnet coils: | |
| Coils burnt out | 5.50 |
| Coils earthed | 3.10 |
| Coils gone altogether | 1.56—10.16 |
| Armatures— | |
| Coils short-circuited and burnt out | 29.00 |
| Coils earthed (that is, failure of installation of frame) | 19.50 |
| Breakage of wire | 15.60 |
| Joint failures | 8.60 |
| Binders burnt | 3.10 |
| Driving horns | 2.35—78.15 |
| Commutators— | |
| Failure of insulation | 10.15 |
| Mechanical failures | 10.95 |
| Surface fusion | 12.50—33.60 |

TABLE II.—*Points of Origin of Breakdowns. The Percentages Given show the Frequency with which the Various Parts Caused Breakdowns.*

| | Per Cent. |
|---|---|
| Mechanical portions— | |
| Shafts | 0.78 |
| Bearings | 8.60 |
| General | 1.65—11.03 |
| Brush gear, leads and terminals— | |
| Mechanical | 3.90 |
| Insulation | 2.35 |
| Leads and terminals | 2.35— 8.60 |
| Field magnets— | |
| Failure of coil insulation | 7.80 |
| Breakage of wire | 0.78— 8.58 |
| Armatures— | |
| Core and slot insulation | 12.50 |
| End insulation (that is, separating bridges) | 5.50—18.00 |
| Coil insulation | 11.70 |
| Joints | 7.00 |
| Fasteners and binders | 1.65 |
| Binder insulation | 7.80 |
| Driving horns | 1.65—47.80 |
| Commutators— | |
| Insulation | 9.40 |
| Fastening and keying | 5.50—14.90 |
| Starters | 4.70 |
| Unknown | 3.13 |
| Various | 1.56 |

TABLE III.—*Causes to which the Failures were Due.*

| | Per Cent. |
|---|---|
| Constructional— | |
| Bad design | 18.36 |
| Perishing of insulation | 7.40 |
| Bad workmanship | 13.60—39.36 |
| Conditional— | |
| Overloading | 1.37 |
| Over-rating | 1.56 |
| Unsuitable | 0.78— 3.71 |
| Maintenance— | |
| Dust and damp | 7.40 |
| Rough usage | 1.56 |
| Defective attention other than above | 22.50—31.46 |
| Accidental and unavoidable, with reasonable care in construction and working | 7.05 |
| Unknown | 13.10 |
| Caused by faults in accessories | 5.48 |

The failure of armatures constitutes by far the most serious item on the table. The form which such failure most frequently assumes is the burning out of coils. In many cases the entire armature was burned out, and in others only a few coils. The percentage of coils gone to earth, 19.5 per cent., is also a large item, and most of these failures were due to destruction of insulation. The accumulation of dust or other conducting matter on the insulating ridges, such as is met with at the end of the slot insulation or at the end of the coil supports of a barrel-wound armature, accounts for the majority of the remainder. Breakages of wire were confined mainly to the smaller sizes of wire-wound armatures, and usually took place at or about the points where the wires leave the coils or join the commutator. The joint failures are more common than they ought to be, although some were undoubtedly caused by short circuiting in another portion of the armature. The 3.1 per cent. in which binders were burnt are those cases where fusing took place by arcing between the binder and armature wires, and did not arise from purely mechanical stresses.

Commutators are frequently damaged, this having occurred in 33.6 per cent. of the breakdowns. The failures of commutator insulation have for the most part occurred at the ends, causing leakages to the earth connected portions of the commutator or between bars or radial connections. In the majority of cases, these failures are caused by the presence of dirt, or other foreign matter, on the insulating ridges or between the radial connections. The mechanical failure of commutators, amounting to 10.95 per cent., consists of burst commutators, fracture of commutator lugs, and failure of keying of commutators. The cases where surface fusion of the commutator has occurred are cases where the surface of the commutator has been destroyed by violent sparking, sometimes between segments, the latter fault being the usual accompaniment of a broken wire.

[To be Continued.]

## ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

LAST Monday the Massachusetts Board of Gas and Electric Light Commissioners gave a hearing on the petition of the Nantucket Gas and Electric Company for the right to increase its capital stock in the sum of $14,000, and to issue bonds in the sum of $20,000. The Company's case was put before the Commissioners by Messrs. F. A. Forbush, A. T. Mowry and J. W. Cawley. There was no opposition. The Company will make notable improvements on its plants next spring.

THE New Haven (Conn.) Gas Light Company has reduced its quarterly dividend to 2 per cent., instead of 2½ per cent. Meanwhile it is only fair to remark this return is paid on a capitalization of $2,000,000, whereas the 2½ per cent. return was made on a capitalization of $1,250,000.

THE following petition, which was recently presented to the New Haven (Conn.) Board of Aldermen, is being considered by the Committee on Public Lighting of that body:

"*Resolved*, That the Corporation Counsel is hereby requested to render an opinion to the Board of Aldermen as to whether or not the city of New Haven can establish an electric light plant for the purposes only of furnishing light for public uses, and to direct the said Board as to the proper procedure to secure the establishment of an electric light plant for the purposes herein mentioned.

"*Resolved*, That the Corporation Counsel is hereby requested and directed to prepare and transmit to the Board of Aldermen a legal and proper form of resolution under which the Board may, if it desires, initiate proceedings to enable the city to establish or acquire a plant for the manufacture of illuminating gas."

AT the shareholders' annual meeting of the Woonsocket (R. I.) Gas Company the officers elected were: Directors, Edwin Aldrich, J. W. Ellis, Darius B. Farnum, Geo. M. Welles, Chas. H. Darling, Chas. E. Ballou, Warren A. Cook, E. A. Mungeon and Austin B. Rankin; Secretary, Reuben G. Randall.

ADVICES by way of Milwaukee are to the effect that the Central Electric Company, of La Crosse, Wis., has purchased the rights and properties of the La Crosse Gas and Electric Company. The price paid is said to have been well above $600,000.

THE proprietors of the San Leandro (Cal.) Gas and Electric Company have reduced the gross selling rate to $1.75 per 1,000 cubic feet. The

former discount schedule for prompt payment—ranging from 5 to 25 per cent.—is unchanged.

THE owners of the San Leandro (Cal.) plant are arranging to construct a gas works in Haywards, Cal.

ANOTHER proposed gas plant is that for Oceanside, Cal. The main party in interest is Mr. K. C. Wells, of Los Angeles.

THE residents of Raynham, Mass., have petitioned the Taunton Gas Company to extend its mains to and through their borough. The work will likely be done next spring.

THE Mayor of Webster City, Ia.—F. A. Edwards—has announced that a special election will be held October 5th, for the purpose of determining whether or not a franchise for the construction and operation of a gas works there shall be granted to Mr. E. S. Springer and his associates.

THE Milwaukee (Wis.) Gas Company has definitely determined to construct and operate a plant for the working up of its bi-products. The plant will be located in North Milwaukee.

AT a recent meeting of the North Side Improvement Club, of Omaha, Neb., the following resolution was adopted: "*Resolved*, That the members of the North Omaha Improvement Club are opposed to the extension of the electric lighting contract for the reason that it will prevent municipal ownership, which we believe will be obtained by the time the present lighting contract expires. We are further opposed to the monopoly of the lighting of the city by the electric light company, for the reason that we believe better results may be obtained by competition, and we much prefer the Welsbach gas post, in the residence portion, instead of the poles and wires of the electric company, which are a dangerous nuisance, detracting much from the beauty of our residence streets."

THE Pennsylvania Railroad Company is negotiating for the erection of gas compressing plants of the Pintsch type at Philadelphia, Harrisburg and Altoona.

THE Riter-Conley Company of Pittsburg, Pa., has been awarded a contract for the construction of a storage holder on the plant of the Cambridge (Mass.) Gas Company. It is to have 4 lifts, and its rated capacity is 4,000,000 cubic feet.

AT the annual meeting of the Concord (N. H.) Gas Light Company no change was made in the extensive management thereof.

A CORRESPONDENT in Monterey (Cal.) writing under date of Sept. 9th says: "The Monterey Gas and Electric Company has been merged with Salinas Water, Light and Power Company, under the name of Monterey County Gas and Electric Company. Directors and officers have been elected as follows: M. V. McQuigg, President; J. M. Gardner, Vice President; R. C. P. Smith, Secretary-Treasurer, Mrs. O. Z. Hubbell, C. W. Allen. Electric current for the entire system will be generated at the power house in Monterey, then transmitted by cable to Salinas, the gas and water plants of the latter city being operated as they now are. The capacity of the local plant will be increased in all departments, machinery having been ordered for that purpose."

MR. THOMAS DUNDERDALE, of Ottawa, Can., has been employed by the Electric Strret Railway Company, Winnipeg, to reconstruct its gas plant at Point Douglas. The system will be changed to that of coal gas. Many main extensions have been arranged for.

THE amended conditions of the charter which permitted certain parties to supply Delray, Woodmere, Springwells and other smaller points not far from Detroit, with gas, has resulted in the formation of the Detroit Gas Light and Coke Company, with a capitalization of $500,000. This organization may not be taken in any eventual sense as conflicting with the rights of the Detroit Gas Company.

SALEM, IA., has voted to establish a municipal gas plant. It is likely to have a plant of the type built by the Practical Gas Company, of Chicago.

MR. MARTIN B. DALY, former Superintendent of the Northwestern Ohio Gas Company (it is of the natural variety) has again decided to make Toledo his home. The Toledo *Bee*, in noting the return, says that Mr. Daly will make frequent trips to Cleveland. Mr. M. S. Greenough and his associates are still making and selling gas in Cleveland.

THE public authorities of Wheeling, West Va., are "pointing with pride" to the fact that they are renewing 10 benches of retorts in the municipal gas works. Displacing instead of removing would look the best plan for improving the efficiency of those benches. Arches and piers and beds will not last forever.

MR. H. S. TAYLOR and Ellis L. Orvis, who have purchased the rights and property of the Bellefonte (Pa.) Gas Company, have asserted that they will put the plant in shape to meet every demand for service that may be made upon it by the residents of the named place. It is hoped they will be up to their word.

MR. CHAS. H. PENNOYER, formerly Manager of the United Gas and Electric Company, of San Jose (Cal.) division of that Company's properties, is now in charge of the Standard Electric Company's interests in the same territory. For an electric man he seems to have much faith in the gas business.

SOME of the residents of New Britain, Conn., are inclined to positively assert that the gas rates in their city are too high.

A CORRESPONDENT forwards the following from Mankato, Minn., under date of the 12th inst.: "The ordinance granting a gas franchise for this place to J. A. Bower and associates is as follows:

"Section 1 gives him and his associates, successors or assigns the right to construct, enlarge, maintain, operate and own gas works in the city, to lay pipes and mains in the streets, alleys and public grounds, to acquire and hold real estate, to manufacture, store, conduct and purify gas, to erect and maintain plants, tanks and lamp posts. He can enter any street or alley, take up any pavement or sidewalk, with the least practical inconvenience to the people. The excavations are to be guarded and lighted whenever necessary, and the streets and alleys, etc., are to be restored to their original condition by Bower. All damages caused by such excavations are to be paid by the grantee, who shall also be liable for any judgment against the city for injury to person or preperty caused by the construction of the works.

"Sec. 2 provides that the gas works shall be completed and ready for operation within 12 months from the acceptance of the franchise, otherwise the franchise be forfeited. Unavoidable delays will work an extension of time.

"Sec. 3 gives the grantee power to make and enforce all reasonable rules and regulations governing the supplying of gas to consumers.

"Sec. 4 requires the grantee to conform to all reasonable rules and regulations of the Council to prevent unnecessary injury to the streets, sidewalks, etc. The pipes and connections shall be laid below the established grade of the streets, alleys, etc. The city shall establish the grade wherever these are to be placed. The grantee shall not interfere with any water pipes, sewers or other property of the city.

"Sec. 5 limits the price to be charged for gas of standard commercial quality to $1 net for 1,000 cubic feet for gas, except that 15 per cent. may be added if the consumer does not pay his bill when due. Meters are to be read and collections made monthly.

"Sec. 6 provides that Bower shall erect on the line of the mains lamps and lamp posts at such places as the city may designate, and shall light and extinguish all street lights. And in consideration of the maintenance of the gas works in the city, the city agrees to purchase for the period of 5 years all of the gas which shall be used by the city at regular consumers' prices.

"Sec. 7 provides that the franchise shall continue for 25 years.

"Sec. 8 includes the penalty clause for interfering with or maliciously injuring any part of the gas plant. The fine is placed at from $1 to $25, or imprisonment for from 1 to 30 days.

"Sec. 9 provides that the grantee, his associates, successors or assigns shall, within 30 days after the passage of the ordinance, file a written acceptance of the same, together with a bond guaranteeing the completion of the works in the manner and within the time specified, in the office of the City Recorder, otherwise the ordinance shall be null and void.

"Sec. 10 is merely technical, but Sec. 11 allows the grantee, etc., to borrow money and to mortgage, lease, sell or assign its franchise and any and all of its property rights in the city."

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
*Germany*—Lemcke & Buechner, of New York.
*England*—Aug. Siegle, 30 Lime Street, London.

MONDAY, SEPTEMBER 21, 1903.

## The Market for Gas Securities.

The tendency of the general market was on the down side during the week. Trading in Consolidated was light, but the recession in quotations was quite pronounced, the net result for the 7 days being a loss of 2½ points in the bid price, the last sale to-day having been made at 171½. No developments are to be recorded in connection with the local gas situation, unless it may be considered that such are shown in the uneasiness of the engineering staff over the productive capacity of the plants being unequal to the demands that will be made upon them this winter. While the capitalists have been making stock, the contractors for plant construction are not even fairly up to their promises of delivery.

The capitalists have the money ready, but the builders are decidedly shy over their ends of the bargainings. However, it is more than an even chance that Chief Bradley and his aids will again do, as they have done before, keep the company's customers supplied. The gain in output is simply astonishing, and we are looking towards Astoria.

Brooklyn Union is lifeless so far as stock sales go, but from an output point of view it is the same in Brooklyn as it is in New York. Peoples, of Chicago, seems to be the pick of the gas basket just now, and anyone conversant with the situation must admit that for a "speculative stock" it has held it own right well in this oddest of financial markets. It is very cheap at the quoted figures.

## Gas Stocks.

**Quotations by George W. Close, Broker and Dealer in Gas Stocks.**

16 WALL STREET, NEW YORK CITY.

SEPTEMBER 21.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

| *N. Y. City Companies.* | *Capital.* | *Par.* | *Bid.* | *Asked.* |
|---|---|---|---|---|
| Consolidated | $73,177,000 | 100 | 171½ | 172¼ |
| Central Union, Bonds, 5's. | 3,000,000 | 1,000 | 105 | 108 |
| Equitable Bonds, 6's | 1,000,000 | 1,000 | 105 | .. |
| " 1st Con. 5's | 2,300,000 | 1,000 | 118 | 120 |
| Metropolitan | 658,000 | .. | 108 | 112 |
| Mutual | 3,500,000 | 100 | 280 | 295 |
| Municipal Bonds | 750,000 | .. | .. | .. |
| New Amsterdam Gas Co.. Bonds, 5's | 11,000,000 | 1,000 | 102 | 106 |
| Northern Union, Bonds, 5's. | 1,250,000 | 1,000 | 105 | 106½ |
| New York and East River Bonds 1st 5's | 3,500,000 | 1,000 | 102 | 106 |
| " 1st Con. 5's | 1,500,000 | | 109 | 111 |
| Standard | 5,000,000 | 100 | 135 | 140 |
| Preferred | 5,000,000 | 100 | 155 | 170 |
| Bonds, 1st Mortgage, 5's | 1,500,000 | 1,000 | 116 | 117 |
| Yonkers | 299,650 | 500 | 130 | .. |
| *Out-of-Town Companies.* | | | | |
| Brooklyn Union | 15,000,000 | 100 | 184 | 200 |
| " " Bonds (5's) | 15 000,000 | 1,000 | 119 | 119½ |
| Bay State | 50,000,000 | 50 | ⅛ | ¼ |
| " Income Bonds | 2,000,000 | 1,000 | . | 75 |
| Binghamton Gas Works.. | 450,000 | 100 | 28 | 30 |
| " 1st Mtg. 5's | 509,000 | 1,000 | 93 | 96 |
| Boston United Gas Co.— 1st Series S. F. Trust | 7,000,000 | 1,000 | 82 | 85 |
| 2d " " " | 3,000,000 | 1,000 | 47½ | 50 |
| Buffalo City Gas Co. | 5,500,000 | 100 | 4 | 5 |
| " " Bonds, 5's | 5,250,000 | 1,000 | 73 | 76 |
| Capital, Sacramento | 500,000 | 50 | .. | 35 |
| Bonds (6's) | 150.000 | 1,000 | .. | .. |
| Central, San Francisco | 1,900,000 | .. | 106 | 108 |
| Chicago Gas Co. Guaranteed Gold Bonds | 7,650,000 | 1,000 | 104 | 104½ |
| Cincinnati Gas & Elec. Co.. | 29,500,000 | 100 | 94¼ | 94½ |
| Columbus (O.) Gas Co., 1st Mortgage Bonds | 1,500,000 | 1,000 | 101 | 101½ |
| Columbus (O.) Gas Lt. & Heating Co | 1,682,720 | 100 | 88¼ | 89¼ |
| Preferred | 3,026,500 | 100 | 107⅞ | 109 |
| Consumers, Jersey City Bonds | 600,000 | 1,000 | 100 | 102 |
| Consumers, Toronto | 1,700,000 | 50 | 218 | 225 |
| Consolidated, Baltimore... | 11,000,000 | 100 | 65 | 65¼ |
| Mortgage, 6's | 3,600,000 | .. | .. | 115 |
| Chesapeake, 1st 6's. | 1,000,000 | .. | .. | .. |
| Equitable, 1st 6's. | 910,000 | .. | .. | .. |
| Consolidated, 1st 5's | 1,490 000 | .. | .. | 112 |
| Consolidated Gas Co. of N.J. | 1,000,000 | 100 | 15 | 17 |
| " Con. Mtg. 5's | 880,000 | 1,000 | 85 | 87 |
| Consolidated G. & E. Co.'s. Little Falls, N.Y. | 90,000 | 100 | .. | 100 |
| Bonds | 75,000 | .. | .. | 100 |
| Detroit City Gas Co | 4,825,500 | 50 | 87 | 95 |
| " Prior Lien 5's | 5,000,000 | 1,000 | 99½ | 100 |
| Detroit Gas Co., 5's | 361,000 | 1,000 | 77 | 79 |
| " Inc. 5's | 16,000 | 100 | 98½ | 100 |
| Equitable Gas & Fuel Co., Chicago, Bonds | 2,000,000 | 1,000 | .. | 101 |
| Essex and Hudson Gas Co. | 6,500,000 | .. | 39 | 40 |
| Fort Wayne | 2,000,000 | .. | .. | .. |
| " Bonds | 2,000,000 | .. | 55 | .. |
| Grand Rapids Gas Lt. Co. 1st Mtg. 5's | 1,225,000 | 1,000 | 104½ | 105 |
| Hartford | 750,000 | 25 | 245 | 265 |
| Hudson County Gas Co., of New Jersey | 10,500,000 | .. | 25 | .. |
| " Bonds, 5's | 10,500,000 | .. | 101 | 103 |
| Indianapolis | 2,000,000 | .. | .. | 75 |
| " Bonds, 6's | 2,650,000 | .. | 104¾ | 106 |
| Jackson Gas Co | 250,000 | 50 | 73 | 75 |
| " 1st Mtg. 5's | 200,000 | 1,000 | 101 | 102½ |
| Kansas City Gas Light Co., of Missouri | 5,000,000 | 100 | .. | 36 |
| Bonds, 1st 5's | 3,822,000 | 1,000 | 102 | 104 |
| Laclede, St. Louis | 10,000,000 | 100 | 79 | 90 |
| Preferred | 2,500,000 | 100 | 85½ | .. |
| Bonds | 10,000,000 | 1,000 | 109½ | 110 |
| Lafayette Gas Co., Ind. | 1,000,000 | 100 | .. | 60 |
| Bonds | 1,000,000 | 1,000 | 60 | 65 |
| Louisville | 2,570,000 | 50 | 136 | 140 |
| Madison Gas & Elec. Co. | | | | |
| " 1st Mtg. 6's | 350,000 | 1,000 | 107½ | 108½ |
| " 6 per cent. scrip, due 1910, | 100,000 | 25 | 85 | 87 |
| Montreal, Canada | 2,000,000 | 100 | 218 | 184¾ |
| Nashville Gas Lt. Co. | 1,000,000 | 100 | 110 | .. |
| Newark, N. J., Con. Gas Co | 6,000,000 | .. | 56 | 58 |
| Bonds, 6's | 4,600,000 | .. | 105 | 106¾ |
| New Haven | 1,000,000 | 25 | 250 | .. |
| Oakland, Cal. | 2,000,000 | .. | 46 | 47 |
| " Bonds | 750,000 | .. | .. | .. |
| Peoples G. L. & Coke Co., of Chicago | 25,000,000 | 100 | 93 | 93¼ |
| Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage | 20,100,000 | 1,000 | .. | .. |
| 2d " | 2,500,000 | 1,000 | 104 | .. |
| Rochester Gas & Elec. Co.. | 2,150,000 | 50 | 88 | .. |
| Preferred | 2,150,000 | 50 | 118 | .. |
| Consolidated 5's | 2,000,000 | .. | 87½ | 90 |
| San Francisco, Cal. | 0,000,000 | 100 | .. | .. |
| St. Joseph Gas Co. " 1st Mtg. 5's | 751,000 | 1,000 | 95 | 96¼ |
| St. Paul Gas Light Co. | 1,500,000 | 100 | 45 | 47 |
| 1st Mortgage 6's | 650,000 | 1,000 | 113 | 116 |
| Extension, 6's | 600,000 | 1,000 | 113¾ | 115 |
| General Mortgage, 5's.. | 2,465,000 | 1,000 | 92 | 93 |
| Syracuse, N. Y. | 1,975,000 | 100 | 46 | 48 |
| Bonds | 2,647.000 | 1,000 | 98½ | 99½ |
| Washington, D. C | 2,600,000 | 20 | .. | .. |
| First mortgage 6's | 600,000 | .. | .. | .. |
| Western, Milwaukee | 4,000,000 | .. | .. | .. |
| Wilmington, Del | 600,000 | 50 | 232 | .. |

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## DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO.,
N. W. CORNER BROAD AND ARCH STS.,
PHILADELPHIA, PA., Sept. 9, 1903

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable Oct. 15th, 1903, to stockholders of record at the close of business, Sept. 30, 1903. Checks will be mailed.

1475-5 LEWIS LILLIE, Treasurer.

## SITUATION WANTED

**As Superintendent of Gas Works,**

By a technical graduate, with 9 years' experience as engineer, chemist and superintendent of coal and water gas plant and bye-product coke ovens. Three years' experience in metallurgy. Engaged at present in gas plant.

1474-4 Address, "C.," care this Journal.

## Situation Wanted

**As Manager or Superintendent of Small Coal or Water Gas Plant,**

By a man 45 years old. Successful and economical in operation and up to developing new business. Thoroughly practical and experienced in all branches. Progressive. First-class references given. Address, "S.,"

1471-tf Care this Journal.

## Position Wanted

**BY A PRACTICAL GAS MANAGER.**

Fifteen years' experience in construction, manufacture and distribution of both coal and water gas in various types. Also able to inventory and place the business and office records upon an improved and proper basis of accounting; being practical and successful in all details of the business. Address, "PROGRESS,"

1469-tf Care this Journal.

## Position Wanted

**As Manager or Superintendent,**

By a young man thoroughly experienced and up-to date in all branches of coal and water gas manufacture. Address,

1476-3 "F. C.," care this Journal.

## WANTED,

**A Position to Take Charge of New Business Department, or to Canvas for Gas Ranges, House Piping and Store Lighting.**

Good experience in the above lines, and can furnish references. State field you have to work on and what salary the position will carry. Address, "EMPLOYED"

1476-5 Care this Journal.

## Situation Wanted.

EXPERIENCED MANAGER thoroughly familiar with every department of the business, coal or water gas. Successful in economical operation and development of new business. Can guarantee results. Energetic and progressive. Good record.

Address, "DIVIDENDS,"

1476-4 Care this Journal.

## WANTED,

**A Competent Gas Maker for Lowe Apparatus,**

By a gas company in Western Illinois. Apply, giving references and salary expected, to

1476-tf "GAS MAKER," care this Journal.

## FOR SALE.

**A 10-FOOT STATION METER.**

One million per 24 hours' capacity. Meter has given excellent satisfaction to date, and only reason for selling is need for a larger meter.

Address, SPRINGFIELD GAS LIGHT COMPANY,

1476-4 Springfield, Mass.

## FOR SALE.

**Four Sections of Wrought Iron Hydraulic Main, Stiness Patent Tar Take-Off; Bridge, Standpipes and Mouthpieces,** with **Self-Sealing Lids** for 7 benches of 6's.
**One Sinuous Friction Condenser.**
**One Walker Tar Extractor.**
**One Standard Scrubber.**
**Four Purifiers,** 10 by 16 complete.
**One 5-Foot Station Meter.**

All of the above apparatus is in good condition, and to be sold as the Company have been obliged to purchase larger for their new works. Address,

TAUNTON GAS LIGHT CO.,

1475-5 TAUNTON, MASS.

## FOR SALE.

**One 6-foot 6-inch Station Meter,** with 10-inch connections and bye-pass valve. Also,

**A Number of Second-Hand 10-inch Flanged Fittings.**

Can deliver at once. Address,

NEW BRITAIN GAS LIGHT CO.,

1474-4 NEW BRITAIN, CONN.

## FOR SALE.

**Two Rectangular, Cast Iron, Water Tube Condensers,** 5 feet 6 inches wide, by 15 feet 10 inches high, by 36 feet 10 inches long, with 20-inch valves and connections.
**One Rectangular, Cast Iron Scrubber,** 5 feet 8 inches wide, by 13 feet high, by 36 feet 10 inches long, with 20-inch valves and connections.
**Sixteen Sections of Cast Iron Hydraulic Main,** 8 feet 4 inches long by 24 inches, for benches of 6's; dip and bridge pipes; 7-inch ascension pipes; supports for hydraulic main; 4 take-off ends, with 12 inch outlets; adjustable valves, with Hutchison tar draw-off pots.
**Seventy-eight Self-Sealing Mouthpieces,** each 12 by 24.
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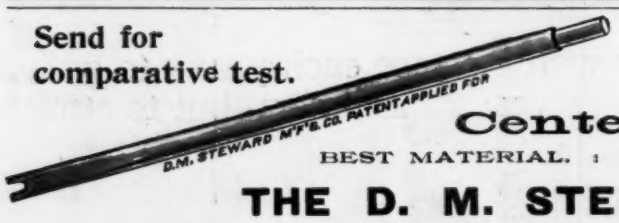


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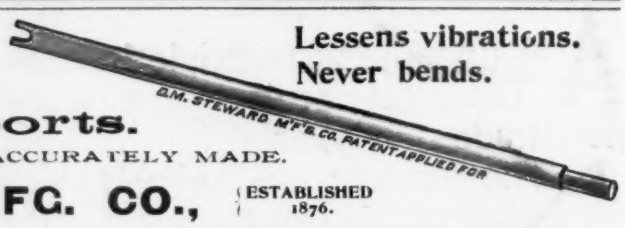


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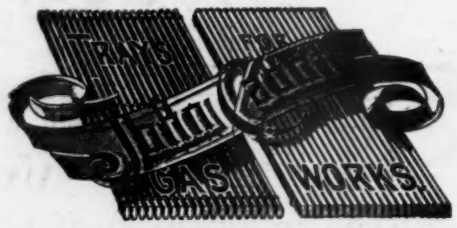


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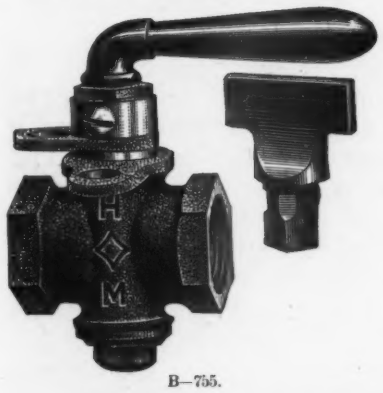

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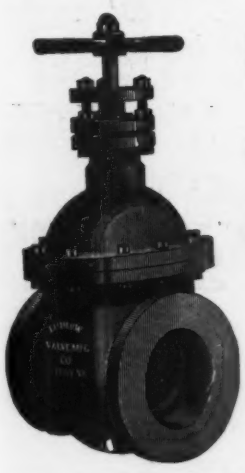

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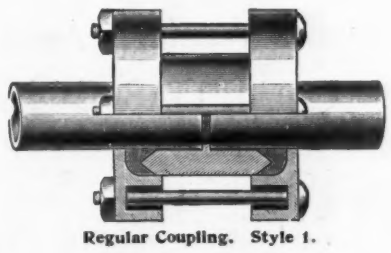

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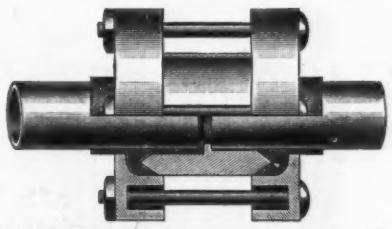

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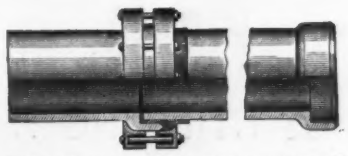

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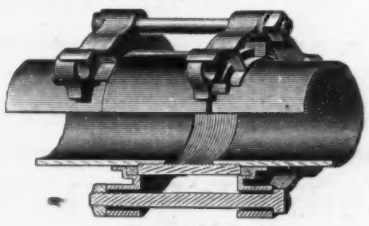

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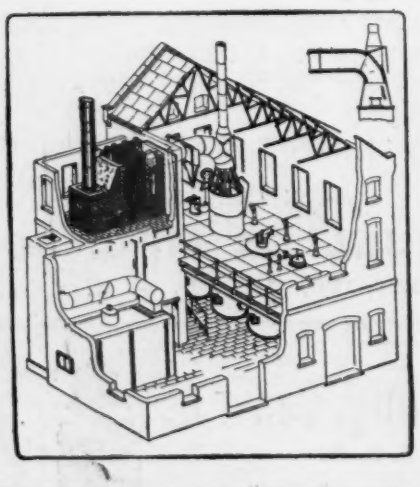

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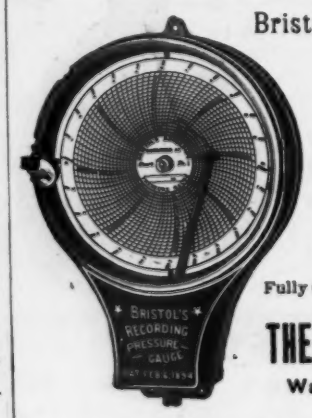


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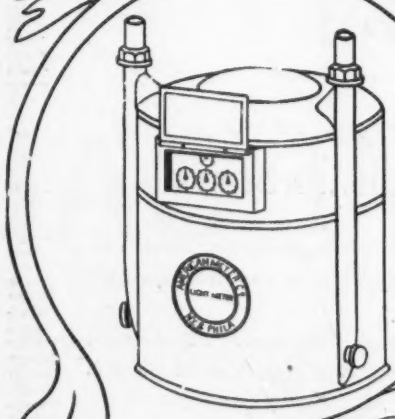
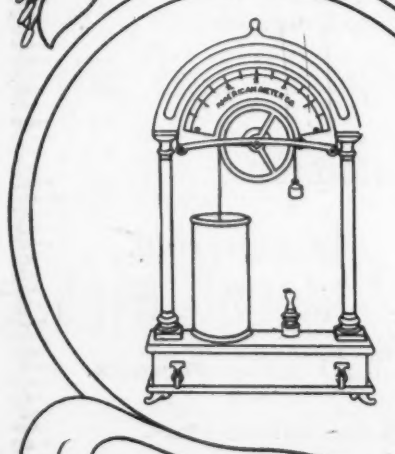
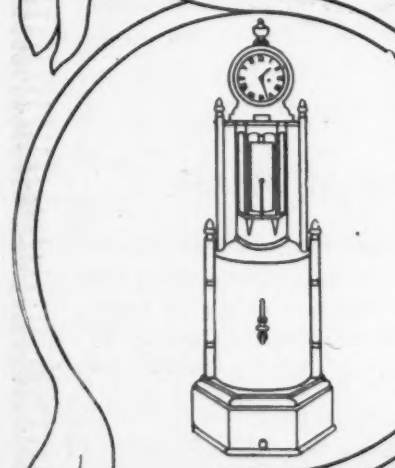
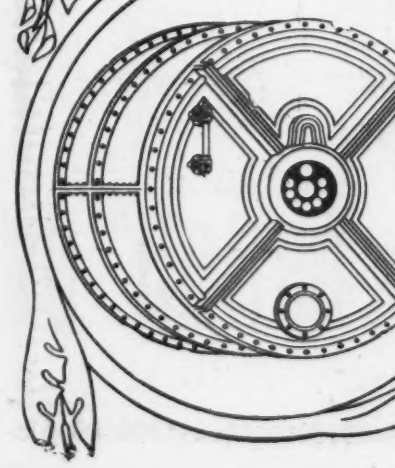




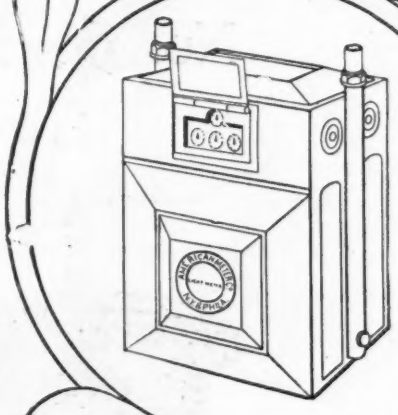


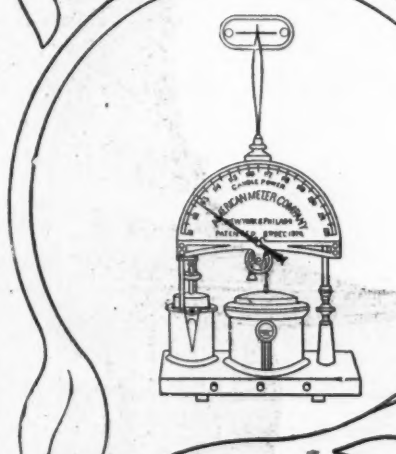


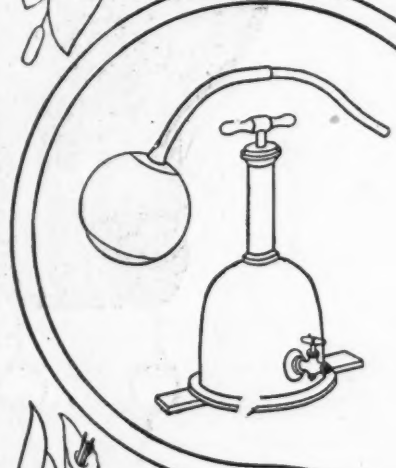
## PUBLIC LIGHTING TABLE.

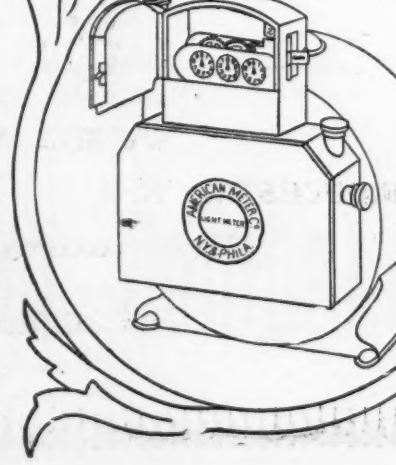
### OCTOBER, 1903.

| Day of Week. | Table No. 1. Following the Moon. Date. | Light. | Extinguish. | Table No. 2. New York City. All Night Lighting. Light. | Extinguish. |
|---|---|---|---|---|---|
| | | | | P.M. | A.M. |
| Thu. | 1 | 1.00 AM | 4.50 AM | 5.30 | 5.00 |
| Fri. | 2 | 2.00 | 4.50 | 5.30 | 5.00 |
| Sat. | 3 | 2.50 | 4.50 | 5.30 | 5.00 |
| Sun. | 4 | 3.50 | 5.00 | 5.30 | 5.00 |
| Mon. | 5 | No L. | No L. | 5.30 | 5.00 |
| Tue. | 6 | No L. FM | No L. | 5.30 | 5.00 |
| Wed. | 7 | No L. | No L. | 5.30 | 5.00 |
| Thu. | 8 | 6.00 PM | 8.00 PM | 5.20 | 5.10 |
| Fri. | 9 | 6.00 | 8.40 | 5.20 | 5.10 |
| Sat. | 10 | 6.00 | 9.20 | 5.20 | 5.10 |
| Sun. | 11 | 5.50 | 10.20 | 5.20 | 5.10 |
| Mon. | 12 | 5.50 | 11.10 | 5.20 | 5.10 |
| Tue. | 13 | 5.50 LQ | 12.20 AM | 5.20 | 5.10 |
| Wed. | 14 | 5.50 | 1.20 | 5.20 | 5.10 |
| Thu. | 15 | 5.50 | 2.30 | 5.10 | 5.20 |
| Fri. | 16 | 5.50 | 3.40 | 5.10 | 5.20 |
| Sat. | 17 | 5.50 | 5.10 | 5.10 | 5.20 |
| Sun. | 18 | 5.40 | 5.20 | 5.10 | 5.20 |
| Mon. | 19 | 5.40 | 5.20 | 5.10 | 5.20 |
| Tue. | 20 | 5.40 NM | 5.20 | 5.10 | 5.20 |
| Wed. | 21 | 5.40 | 5.20 | 5.10 | 5.20 |
| Thu. | 22 | 5.40 | 5.20 | 5.00 | 5.30 |
| Fri. | 23 | 5.40 | 5.20 | 5.00 | 5.30 |
| Sat. | 24 | 5.40 | 5.20 | 5.00 | 5.30 |
| Sun. | 25 | 8.10 | 5.20 | 5.00 | 5.30 |
| Mon. | 26 | 9.00 | 5.20 | 5.00 | 5.30 |
| Tue. | 27 | 10.00 FQ | 5.20 | 5.00 | 5.30 |
| Wed. | 28 | 10.50 | 5.20 | 5.00 | 5.30 |
| Thu. | 29 | 11.50 | 5.20 | 4.45 | 5.35 |
| Fri. | 30 | 12.40 AM | 5.20 | 4.45 | 5.35 |
| Sat. | 31 | 1.40 | 5.20 | 4.45 | 5.35 |









## TOTAL HOURS LIGHTING DURING 1903.

| By Table No. 1. | Hrs. Min. | By Table No. 2. | Hrs. Min. |
|---|---|---|---|
| January | 245.00 | January | 423.20 |
| February | 192.00 | February | 355.25 |
| March | 201.00 | March | 355.35 |
| April | 167.20 | April | 298.50 |
| May | 152.00 | May | 264.50 |
| June | 131.00 | June | 234.25 |
| July | 140.40 | July | 243.45 |
| August | 156.20 | August | 280.25 |
| September | 171.20 | September | 321.15 |
| October | 198.20 | October | 374.30 |
| November | 216.30 | November | 401.40 |
| December | 232.10 | December | 433.45 |
| Total, yr. | 2203.40 | Total, yr. | 3987.45 |

# No. 904 Welsbach Outdoor Arc

**Furnished with 2, 3, 4 or 5 Burners**

## This Lamp is Built to Stand

rough usage and severe weather conditions. In mechanical construction and workmanship it is perfect.

The material is of the best. All exposed metal parts made of cold rolled sheet copper.

Guaranteed Positively

**Rain-proof**

**Wind-proof**

**Insect-proof**

The main cock lights one or all burners. Pilot flash light.

18-inch enameled steel reflector shade.

Long tube burners, with adjustable needle gas feed, permit use of either 3½-inch or 4½-inch mantles.

## Renewal of Mantle

made easy and without danger of breakage by raising the body of the lamp on main stem. The neck of the globe thus acts as a wind guard, protecting the other mantles from damage by weather conditions.

## Candle Power Test

of 4-burner lamp:

With 3½-inch mantles, 412-candle power.

With 4½-inch mantles, 503-candle power.

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**Sample Case** of 3, 6 or 12 lamps sent on 30 days' approval at prices based on 100 lamps.

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|---|---|---|
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| Amesbury, Mass. | Lynn, Mass. | Savannah, Ga. |
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| Winsted, Conn. | Washington, D. C. | Cicero, Ills. |
| Canon City, Col. | Boone, Ia. | Chicago (Ogden Co.) |
| Schenectady, N. Y. | Pueblo, Col. | Easton, Pa. |
| Hagerstown, Md. | Charlotte, N. C. | Lawrence, Mass. |
| Malden, Mass. | Fall River, Mass. | Council Bluffs, Ia. |
| Bridgeport, Conn. | Duluth, Minn. | Chattanooga, Tenn. |
| Albert Lea, Minn. | New York (Mutual Co.) | |

TOTAL SETS TO JULY 1, 1903, . . . . . 51
TOTAL DAILY CAPACITY, . . . . 55,150,000 cubic feet.
TOTAL SETS TO DATE, . . . . . 498
TOTAL DAILY CAPACITY, . . . . 354,830,000 cubic feet.

## The United Gas Improvement Company,

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Established 1858. Incorporated 1890.
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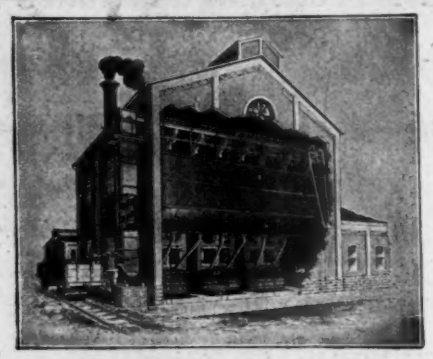

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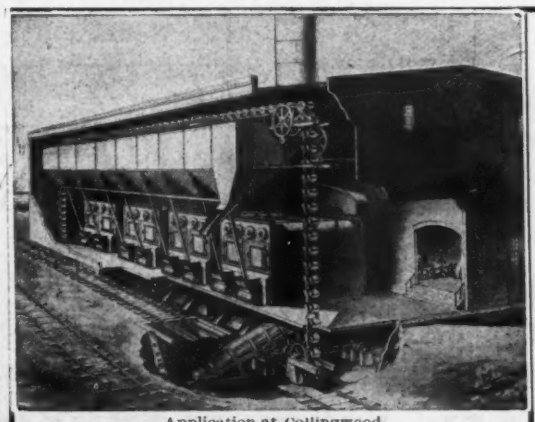

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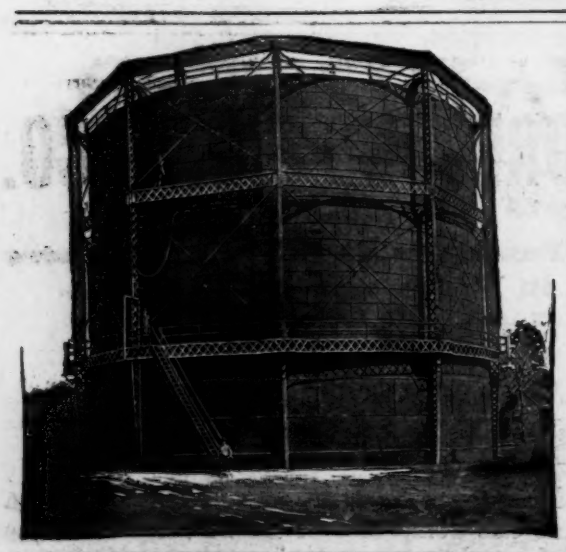

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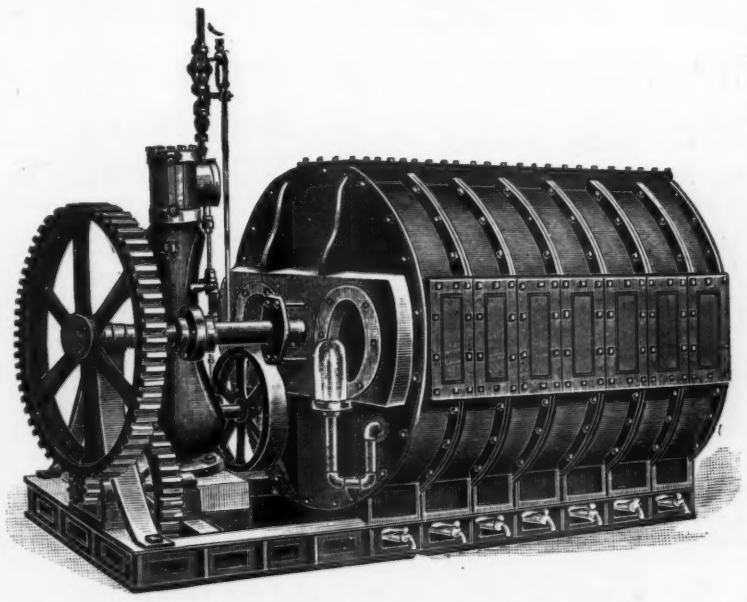

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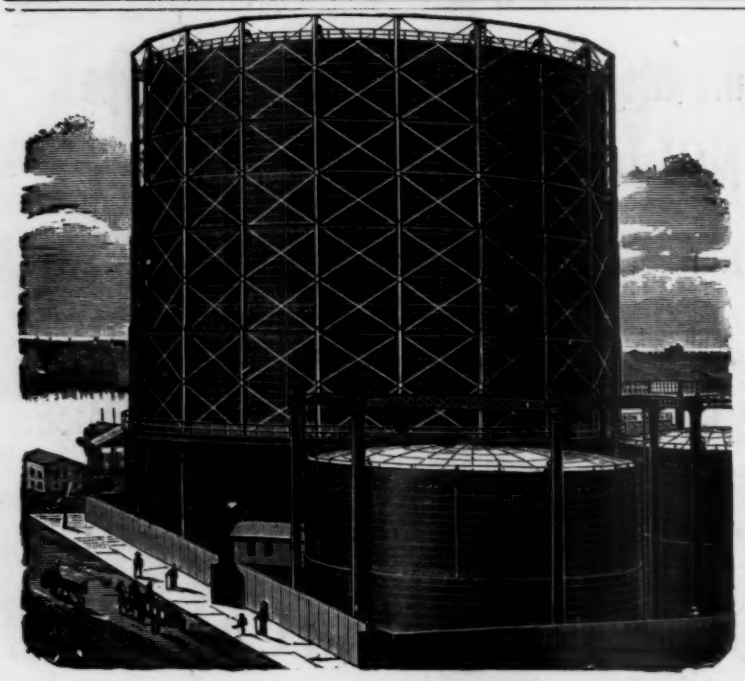

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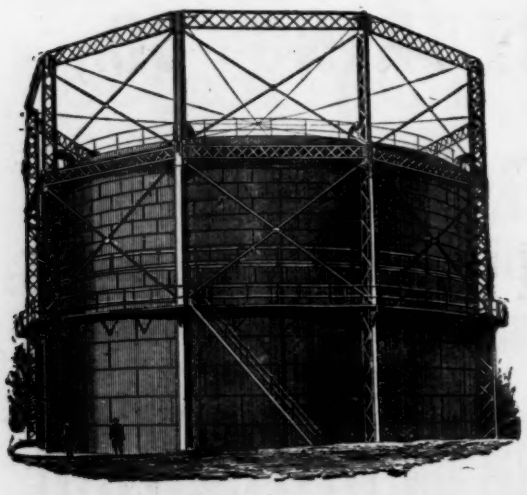

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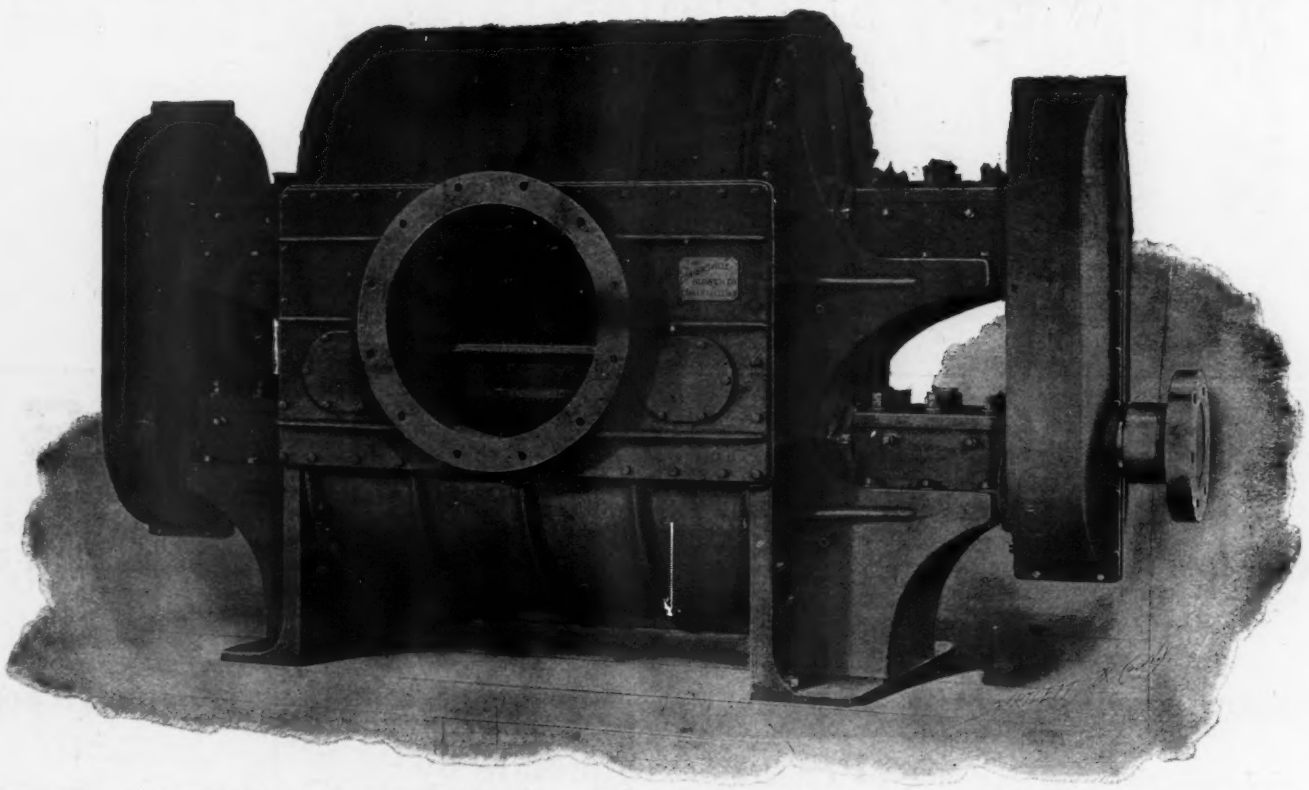

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